State of Connecticut

PUBLIC DOCUMENT No. 24

Fiftieth Report

OF THE

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

FOR THE YEAR

1926

271

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PUBLICATION

APPROVED BY

THE BOARD OF CONTROL

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY
New Haven, Conn.

I

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

as of

October, 1926

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Soil Research.	M. F. Morgan, M.S., *Investigator.* H. G. M. Jacobson, M.S., *Assistant.*
Tobacco Sub-station at Windsor.	Paul J. Anderson, Ph.D., *Pathologist in Charge.* N. T. Nelson, Ph.D., *Assistant Physiologist.*

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Report of the Board of Control

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

To His Excellency, John H. Trumbull, Governor of Connecticut:

The Board of Control of the Connecticut Agricultural Experiment Station herewith respectfully submits its fiftieth report for the year ending October 31, 1926.

The following changes in the Station Staff have occurred:

Mr. George D. Scarseth, B.S., Assistant in Soils, resigned in August, 1926, to take a position as Soil Investigator with the United Fruit Company in Honduras. Mr. H. G. M. Jacobson, M.S., Instructor in Soils at the Arkansas Agricultural College, has been appointed to fill this vacancy.

Mr. R. E. Andrew, M.A., for six years First Assistant in Analytical Chemistry, resigned in March, 1926, to take a commercial position.

Two years ago the Plant Breeding Department began an intensive study of the problems connected with the improvement of the vegetable crops. To assist in this work Mr. H. B. Murray, B.S., Assistant in Horticulture at the Experimental Farms, Ottawa, Canada, was appointed Assistant in Plant Breeding in May, 1926.

A very attractive exhibit was made at the Connecticut State Fair in Hartford. While such undertakings consume much time of members of the staff it furnishes a means of bringing before the people the work of the Station and much information is thus disseminated.

The Annual Field Day at the Mt. Carmel farm was held July 28th. It has been the custom for some years to develop the Field Day program around one of the important industries of the state and this year special attention was given to vegetable growing. The Connecticut Vegetable Growers' Association and the New Haven County Farm Bureau both joined in this Field Day and there was in attendance over 400 people. Director R. L. Watts of the Pennsylvania Experiment Station gave the principal address.

The Field Day at the Tobacco Station at Windsor was held on July 30th. Here again a very good attendance was recorded, farmers from all of the tobacco towns being present to inspect the plots and experiments.

Since the issuance of the last report the new greenhouse has been completed and has proven its value by making possible winter experiments in plant breeding and soil fertility. At the Mt. Carmel farm a small seed barn has been erected for the work in plant breeding.

Nine hundred volumes were added to the Library, which now numbers 16,400 volumes and includes a very complete list of scientific journals.

As usual the members of the Station staff have delivered frequent lectures before farmers' meetings and other groups and have handled the many inquiries for information that come in the mails. Forty-eight thousand bulletins have been mailed to the regular mailing list and others as requested.

The following brief summary will show the scope of the Station's work:

CONTROL AND SERVICE ACTIVITIES.

FERTILIZERS. Four hundred and twenty-two brands were registered for sale in Connecticut, for the inspection of which 540 official samples were drawn. In addition 249 samples were received from farmers, making a total of 789. Considering official samples only, 87% of the guaranties have been substantially met or exceeded and of those below guaranty four percent showed a shortage of $1.00 or more.

FEEDING STUFFS. Under the new statute (1925) 651 brands were registered by 161 firms. The laboratory analysed 755 samples, part of which were official and part submitted by farmers. Of the 488 official samples, 164 were proprietary poultry feeds, indicating the importance of this industry in the state.

FOOD AND DRUGS. In the task of protecting the public against adulterated and illegal foods and drugs the Station examined 1,700 samples. Most of these were drawn by the Dairy and Food Commissioner, who is charged with the administration of the statute. Of these some 300 were adulterated, below standard or otherwise illegal.

SEED TESTING. The Station was a pioneer in establishing seed testing in this country, the Report for 1877 including the results on 33 samples of grass, clover and vegetable seeds. Every year since that time a considerable number of samples have been examined for purity and germination. In 1926, through the coöperation of the Commissioner of Agriculture, a special study was made of the quality of vegetable seed sold in packets in the state. The results are published in Bulletin 283, herewith.

INSECT PEST AND PLANT DISEASE CONTROL. As usual the Station entomologists have carried out the careful inspection of

orchards and nurseries, the scouting for and suppression of the Gipsy Moth and the European Corn Borer and a special campaign against the Asiatic Beetle, which was discovered in New Haven and vicinity.

A new service was established for the benefit of fruit growers, the botanists and entomologists making special inspections of orchards in order to secure information to be used in the spray service distributed by the State Pomological Society and the Extension Service.

During the past year one of the botanists has collaborated in the orchard and nursery inspection, thereby providing extra protection against the spread of plant diseases.

The Station forester has continued to conduct the eradication of White Pine Blister Rust, the operations for the year having centered in the towns of Salisbury and Canaan.

PROGRESS OF INVESTIGATIONS.

BIOCHEMISTRY. Studies on the effect of diet on rate of growth have been continued with surprising results. Not only is the rate greatly increased, but some of the rats under experiment have attained unusual size in a relatively short time. These experiments raise many new problems for investigation: What is the nature of the chemical substances that may be responsible? Are there specific stimulants to growth? The answers to these and other questions are being sought.

The nature of the vegetable proteins has continued to occupy much time and we are gradually arriving at a better knowledge of the substances present and methods for their quantitative determination. This work is of far-reaching economic importance for until our knowledge of plant composition is more complete, our methods of fertilization are without adequate foundation.

BOTANY. The mosaic disease of tobacco and other plants has been studied for many years by botanists in all parts of the world. As yet the cause is not definitely known. A most interesting discovery made at the Station this year is the fact that tobacco leaves, dried and preserved for 24 years, still carry the active principle and can be used to infect growing plants.

A complete list and description of the Rusts of Connecticut has been prepared for publication.

Comparisons of various dusts and sprays on apples have been continued as usual. Each year new products that appear on the market are added to the tests.

The control of celery blight has been studied for three years. The results favor spray rather than dust as a remedy.

The possibility of reëstablishing the chestnut is receiving atten-

tion. One thousand seedlings have been set out to determine if the danger of infection is yet past.

A new investigation begun this year is a thorough study of certain tree diseases, especially wood decays and their prevention.

ENTOMOLOGY. Progress is being made on the investigation of the plum curculio on apple. It appears that operations other than spraying may sometimes be necessary to obtain clean fruit.

The Asiatic beetle, which appeared last year in New Haven, has been very actively studied as this is a new pest in the United States. Up to the present its injury to plants is confined to lawns in which the grubs live.

The investigation of the birch leaf skeletonizer is completed and the results appear as part of this report as bulletin No. 288.

Continued efforts have been made to find better controls for the squash borer, cabbage maggot and spinach leaf miner.

The oriental peach moth is one of our worst peach pests and as yet no control has been discovered. Many experiments have been conducted with sprays, bait and poisons placed in the trees.

Other insects studied were the birch leaf miner, spruce gall aphid and imported currant worm.

PLANT BREEDING. A product of the investigation of sterility in corn is the discovery of a factor for sterile tassels, which is linked with color of the kernel. By separating these seeds according to color it is possible to grow plants that do not produce pollen and these may be used in the production of "crossed corn," thus relieving the grower of the labor of detasseling alternate rows.

A new mutation from red to white silk color has occurred in one of the pure inbred strains.

Two hundred crosses between inbred strains of sweet corn have been made. Some of these show marked improvement over the original variety.

Selection in self-fertilized lines is also being applied to a large number of vegetables with the aim of better adapting the standard varieties to local market requirements.

FORESTRY. The experimental plantings continue to yield valuable information on the relative value of different conifers for planting on poor sandy land. These stands have now reached a size that make them valuable also for many other observations and experiments in silviculture.

A survey of all the pine plantations in the state is now being made to learn what soils have given the best growth.

A tract on the Cockaponset State Forest in Haddam was selected for intensive study of the influence of soil on the composition and rate of growth of the forest. Good progress resulted on this project, the data proving very encouraging.

SOILS. The inventory of the soils of the state was practically completed. Sixteen type areas, comprising 300,000 acres, have been carefully studied, and 51 soil series classified. A key by which these can be identified has been devised.

In the laboratory these soils have been analyzed and new methods devised, especially one for determining acidity. This has made possible a study of hundreds of tobacco fields to determine the degree of acidity which is correlated with the quality of the tobacco and the possible outbreaks of root rot.

Old tobacco soils were found to contain an adequate supply of available phosphorus, this information offering growers an opportunity to reduce the cost of fertilizer.

TOBACCO SUB-STATION AT WINDSOR. The report for 1926 is included herewith as Tobacco Bulletins 7 and 8. The former gives the results of the investigation of the needs of phosphorus on old tobacco soils mentioned above. The latter bulletin is a report of all the experiments at Windsor. These include the fertilizer trials, studies of tobacco nutrition, diseases, curing, breeding, insect pests, topping and suckering, and tests of chemically treated shade cloth.

PUBLICATIONS

Bulletins.

No. 270. Fertilizer Report for 1925.
No. 271. Spray Bulletin.
No. 272. Report on Commercial Insecticides and Fungicides 1925.
No. 273. Crossed Corn.
No. 274. Report of the Director for the Year Ending Oct. 31, 1925.
No. 275. Report of the State Entomologist, for 1925.
No. 276. Report on Food and Drug Products (1925).
No. 277. Report on Commercial Feeding Stuffs (1925).
No. 278. A Chemical Investigation of Some Standard Spray Mixtures.
No. 279. The Genetics and Morphology of Some Endosperm Characters in Maize.
No. 280. Semi-Centennial of the Connecticut Agricultural Experiment Station.
No. 281. General Index to the Reports of the State Entomologist (1901-1925).

Tobacco Series.

No. 6. Report of the Tobacco Station at Windsor (1925).

Circulars of Immediate Information.

No. 51. Regulations Concerning the Transportation of Nursery Stock in the United States and Canada.
No. 52. A New Pest of Lawns.
No. 53. The Asiatic Beetle Quarantine.
No. 54. The Gipsy Moth Quarantine.

Journal Papers.

The Acceleration of Growth.
Thomas B. Osborne and Lafayette B. Mendel.
National Academy of Sciences, Science, 1926, LXIII, 528-529.

The Relation of the Rate of Growth to Diet. I.
Thomas B. Osborne and Lafayette B. Mendel.
Journal of Biological Chemistry, 1926, LXIX, 661-673.

Some Nitrogenous Constituents of the Juice of the Alfalfa Plant.
IV. The Betaine Fraction.
Hubert Bradford Vickery.
Journal of Biological Chemistry, 1925, LXV, 81-89.

Some Nitrogenous Constituents of the Juice of the Alfalfa Plant.
V. *The Basic Lead Acetate Precipitate.*
Hubert Bradford Vickery and Carl G. Vinson.
Journal of Biological Chemistry, 1925, LXV, 91-95.

Some Nitrogenous Constituents of the Juice of the Alfalfa Plant.
VI. Asparagine and Amino Acids in Alfalfa.
Hubert Bradford Vickery.
Journal of Biological Chemistry, 1925, LXV, 657-664.

On the Separation of Histidine and Arginine.
Hubert Bradford Vickery and Charles S. Leavenworth.
Journal of Biological Chemistry, 1926, LXVIII, 225-228.

Simpler Nitrogenous Constituents of Yeast. I. Choline and Nicotinic Acid.
Hubert Bradford Vickery.
Journal of Biological Chemistry, 1926, LXVIII, 585-592.

A Histological Study of the Sterility in the Albino Rat Due to a Dietary Deficiency.
Karl E. Mason.
Proceedings of the National Academy of Sciences, 1925, XI, 377-382.

Testicular Degeneration in Albino Rats Fed a Purified Food Ration.
Karl E. Mason.
Journal of Experimental Zoology, 1926, XLV, 159-229.

The Relation of Diet to the Eye.
Arthur M. Yudkin.
New York State Journal of Medicine, Jan. 15, 1926.

Injuries and Diseases of the Peach in Connecticut.
G. P. Clinton.
Connecticut Pomological Society Report. (1925) 35: 29-38, 1926.

Diseases of Vegetables; Spinach Blight; and Celery Spraying.
G. P. Clinton.
Conn. Vegetable Growers' Rpt., 1925: 19-29.

Review of "The Production and Liberation of Spores in the Hymenomycetes and Uredineae, by A. H. Reginald Bullar."
G. P. Clinton.
Science LXIII, 571-2, 1925.

Brief Notes on the Progress of Spraying and Dusting Experiments of the Past Season.
E. M. Stoddard.
Conn. Pom. Soc. Rpt. (1925) 35: 15-20, 1920.

The Uredinales or Rusts of Connecticut and the Other New England States.
W. R. Hunt.
Conn. State Geol. & Nat. Hist. Sur. Bul. 36, 158 pages. In press.

Borers in Relation to Cavities in Trees.
W. E. Britton.
Tree Talk, Spring Number, March, 1925.

Red Mite and Railroad Worm.
W. E. Britton.
Rpt. of Thirty-second Annual Meeting of the Mass. Fruit Growers' Assoc., Inc., pp. 175-181, May, 1926.

Rpt. of Committee on Injurious Insects.
W. E. Britton.
Proceedings of the Thirty-fifth Annual Meeting, Conn. Pom. Soc., pp. 38-43, April.

Insects Attacking Vegetable Crops in Connecticut in 1925.
W. E. Britton.
Rpt. of Conn. Vegetable Growers' Assoc., for 1925, pp. 13-20, August.

Three Injurious Insects Recently Introduced into Conn.
W. E. Britton.
Jour. of Economic Entomology, Vol. 19, pp. 540-545, June.

Some Insects and Entomologists.
W. E. Britton.
Fifty-sixth Annual Report of Entomological Soc. of Ontario, pp. 55-63, Sept.

The Oriental Peach Moth Problem in Conn.
Philip Garman.
Proceedings Thirty-fifth Annual Meeting, Conn. Pom. Soc., pp. 44-47, April.

Effect of the Order of Mixing Various Spray Ingredients on the Formation of Injurious Compounds.
R. E. Andrew and Philip Garman.
Journal of Economic Entomology, Vol. 19, p. 671, August.

Heritable Characters of Maize. XXIII—Silkless.
D. F. Jones.
Journal of Heredity, Vol. XVI, No. 9, Sept. 1925.

All of which is respectfully submitted,

GEORGE A. HOPSON,

Secretary.

Report of the Treasurer

July 1, 1925—June 30, 1926

W. L. Slate, in account with The Connecticut Agricultural Experiment Station for the fiscal year ended June 30, 1926.

RECEIPTS.

Balance on hand, July 1, 1925:			
State General (Current Expense Appropriation)		....	
Miscellaneous Receipts		$157.38	
			$157.38
State Appropriation (General or Current Expense)		$53,000.00	
" " (General) (Additions)		1,537.06	
" " (Food)		7,500.00	
United States Appropriation (Hatch)		7,500.00	
" " " (Adams)		7,500.00	
" " " (Purnell)		10,000.00	
Fertilizer Analysis Fees		12,000.00	
Feed Analysis Fees		7,000.00	
Lockwood Trust Fund (including sales of tree seedlings and Mt. Carmel Farm produce)		10,000.00	
			116,037.06
Miscellaneous Receipts:			
Sales of gasoline	$436.92		
Sales of automobile oil	26.36		
Mileage for use of automobiles	173.54		
Court Fees	1,286.13		
Sales of old iron and paper	32.29		
Sale of old mower	39.40		
Payment by C. G. Bartlett for part cost of wire fence	25.00		
Miscellaneous	5.00		
Interest on bank deposits	20.08		
		$2,044.72	
LESS MISCELLANEOUS RECEIPTS DEPOSITED WITH STATE TREASURER		1,544.70	
			500.02
			$116,694.46

DISBURSEMENTS.

Salaries	$70,990.00
Labor	13,734.72
Stationery and Office Supplies	845.81
Scientific Supplies (chemicals)	751.74
" " (other laboratory)	779.33
" " (photographic)	65.28
Feeding Stuffs	273.98
Insecticides, Fungicides, etc.	4.75
Lumber and Small Hardware	95.18
Miscellaneous Supplies	1,219.01

Automobile Oil	$49.99	
Food Samples	16.60	
Fertilizers	642.80	
Telegraph and Telephone	366.82	
Postage	401.37	
Travel *(outlying investigations)*	2,013.67	
" (meetings, etc.)	533.50	
" *(gasoline)*	1,005.30	
Freight, Express and Parcels Post	186.04	
Publications *(bulletins, etc.)*	392.15	
" (miscellaneous)	81.33	
Coal	1,483.80	
Gas and Electricity	1,813.10	
Water	147.05	
Furniture and Fixtures (new)	508.57	
" " " *(repairs)*	116.24	
Library (books and periodicals)	962.45	
" *(binding)*	......	
Scientific Equipment (new)	539.28	
" " (repairs)	27.20	
Automobiles (new)	765.00	
" (repairs)	656.46	
Tools, Machinery and Appliances (new)	1,051.02	
" " " " (repairs)	79.10	
New Buildings and Structures	4,558.46	
Buildings (repairs and alterations)	2,213.99	
Grounds	407.28	
Insurance (fire, burglary and automobile)	1,128.07	
Taxes	28.99	
Miscellaneous Contingent Expenses	169.50	
Total Disbursements (not including Insect Pest)		$111,104.93
Balance on hand, June 30, 1926:		
State General Appropr. (in hands of State Comptroller)	$4,932.13	
Miscellaneous Receipts (in hands of Station Treas.)	657.40	
		5,589.53
		$116,694.46

REPORT OF

W. L. SLATE, Treasurer

IN ACCOUNT WITH

Insect Pest Appropriation

July 1, 1925—July 1, 1926

RECEIPTS.

Balance on Hand, July 1, 1925:			
Insect Pest Appropriation		$17,500.00	
" " " (additions)		40.18	
		$17,540.18	
Miscellaneous Receipts:			
Mileage for use of automobiles	$38.52		
Sale of honey	8.20		
	$46.72		
LESS MISCELLANEOUS RECEIPTS DEPOSITED WITH STATE TREASURER	40.18		
		6.54	
			$17,546.72

DISBURSEMENTS.

Salaries	$14,010.50
Labor	3,711.30
Stationery and Office Supplies	73.88
Scientific Supplies (chemical)	35.54
" " (other laboratory supplies)	62.59
" " (photographic)	30.48
Lumber and Small Hardware	8.55
Miscellaneous Supplies	203.64
Fuel Oil	1,700.47
Automobile Oil	5.85
Telegraph and Telephone	16.46
Postage	74.55
Travel (outlying investigations)	437.90
" (meeting, conferences, etc.)	166.49
" (gasoline for automobiles)	186.01
Freight, Express and Parcels Post	53.44
Furniture and Fixtures (new)	8.58
Library (books and periodicals)	38.23
Scientific Equipment (new)	57.40
Tools, Machinery and Appliances (new)	219.98
" " " " (repairs)	4.51
Automobiles (repairs)	390.83

New Buildings and Structures	$337.05	
Rent of Land	66.66	
Insurance (automobile)	172.07	
Miscellaneous Contingent Expenses	35.15	
Total Disbursements		$22,108.11
*Shortage, June 30, 1926 (for the year)	$4,567.93*	
LESS MISCELLANEOUS RECEIPTS IN HANDS OF STATION TREASURER	6.54	
*Total shortage		4.561.39*
		$17,546.72

* Charged to allotment for second year of fiscal period.

REPORT OF

W. L. SLATE, Director

IN ACCOUNT WITH

Mosquito Elimination Appropriation

For the Fiscal Year Ending June 30, 1926

RECEIPTS.

Balance on hand, July 1, 1925 (Petty Cash Fund) ..	$ 500.00	
State Appropriation	7,500.00	
Additions to Appropriation (Contribution from Towns)	1,029.80	
Total		$9,029.80

EXPENDITURES.

Salary	$2,300.00	
Labor	5,359.17	
Use of auto carrying men to work and back	296.53	
Photographic Supplies	3.85	
Stationery and Office Supplies	2.85	
Hardware Supplies	6.41	
Miscellaneous	36.05	
Automobile Oil	4.59	
Oil for Mosquito Spraying	7.00	
Telephone and Telegraph	4.32	
Postage (excluding parcels post)	24.36	
Travel (outlying investigations)	53.91	
" (meetings)	32.54	
" (gasoline)	139.71	
Freight, cartage and express	2.26	
Publications	30.45	
Furniture and Fixtures (new)	50.00	
Automobiles (new)	1,125.00	
" (repairs)	114.81	
Tools, Machinery and Appliances (new)	58.22	
" " " " (repairs)	11.30	
Buildings (new culverts at Westbrook)	25.70	
Repairs and alterations to structures	20.25	
Insurance (automobile)	65.69	
Contingent	4.00	
		$9,778.97
Balance on hand, July 1, 1926 (Petty Cash Fund) ..		500.00
		$10,278.97
Charged to allotment for second year of fiscal period		1,249.17
		$9,029.80

REPORT OF

W. L. SLATE, Director

IN ACCOUNT WITH

Tobacco Research Appropriation

For the Fiscal Year Ending June 30, 1926

RECEIPTS.

State Appropriation	$10,000.00	
Additions to Appropriation (Sales of Tobacco, etc.)	9,565.57	
Total		$19,565.57

EXPENDITURES.

By the State Comptroller on vouchers submitted by W. L. Slate, Jr., Director:		
Salaries	$6,649.98	
Labor	4,634.39	
Stationery and Office Supplies	82.01	
Chemicals and Laboratory Supplies	8.37	
Photographic Supplies	31.31	
Insecticides and Fungicides	31.80	
Lumber for repairs; small hardware; misc. supplies	704.44	
Automobile Oil	5.70	
Fertilizer	585.08	
Telegraph and Telephone	99.73	
Travel (outlying investigations)	8.70	
" (meetings)	18.40	
" (gasoline)	56.44	
Postage	100.63	
Freight, express and cartage	14.35	
Coal	317.01	
Electricity	168.44	
Water	5.00	
Furniture and Fixtures (repairs)	5.84	
Books and Periodicals	16.00	
Scientific Apparatus (new)	3,252.33	
" " (repairs)	10.48	
Automobiles (new)	160.00	
" (repairs)	77.25	
Tools, Machinery and Appliances, (new)	31.60	
" " " " (repairs)	5.23	
Buildings (repairs and alterations)	*670.02*	
Rent of Land	75.00	
Insurance (on automobile, buildings and tobacco)	118.00	
Contingent	1.50	
		$17,945.03
Balance on hand July 1, 1926		$1,620.54

BULLETIN 282 NOVEMBER, 1926

Connecticut Agricultural Experiment Station
New Haven, Connecticut

Report on Inspection of Commercial Fertilizers for 1926

E. M. BAILEY, *Chemist in Charge of the Analytical Laboratory.*

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

as of

October, 1926

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Report on Inspection of Commercial Fertilizers, 1926

E. M. Bailey,

Chemist in Charge, Analytical Laboratory.

THE FERTILIZER LAW.

The provisions of the Connecticut fertilizer law have been discussed in previous reports but for more ready reference its essential features may be noted here.

Significance of the Term "Commercial Fertilizers"

Explaining what is meant by the term "commercial fertilizers" the law says:

"The term 'commercial fertilizers' shall be construed to mean any and every substance imported, manufactured, prepared or sold for fertilizing or manuring or soil amendment purposes, except barnyard manure and stable manure which have not been artificially treated or manipulated, marl and lime. Cottonseed meal, rapeseed meal, castor pomace and all other vegetable products used as fertilizers, including the ashes of cotton hulls and wood ashes, shall be included as fertilizers within the meaning of this act and separate analysis fees shall be paid on each different grade which is sold or offered for sale in the state. The person responsible for paying the fees above prescribed may deduct from the total tonnage sold such sales of cottonseed meal or other vegetable products as are made to anyone who gives a written certificate on a form supplied by the Connecticut Agricultural Experiment Station stating that the material bought by him was to be used exclusively for feed and not for fertilizer."

Concerning Cottonseed Meal.

Cottonseed meal is a fertilizer within the meaning of the Statute but it is provided that when this product is sold for feeding purposes only, it shall be exempt from the tonnage tax.

The status of cottonseed meal under the fertilizer law has been clearly stated in a bulletin[1] from this Station from which the following may be quoted:

Registration and analysis fees. "Each brand of cottonseed meal must be registered on forms provided by this Station and an analysis fee of ten dollars paid on it before it is sold, offered or exposed for sale, and on the first day of January annually thereafter."

[1] Bull. of Information No. 9, 1919.

"A distinctive name constitutes a distinct brand. If shipments have different guaranties of composition they are held to be different brands."

Branding or tagging. "Since nitrogen is the only fertilizer ingredient considered in the trade in cottonseed meal no guaranty of phosphoric acid or potash is required. If either is guaranteed by the manufacturer, however, an additional fee of ten dollars must be paid on each element. The statement of composition now legal for feeds may be used hereafter if the percentage of nitrogen is stated.

"Note that the law regarding feeding stuffs forbids the use of metal in attaching tags and requires that each package shall be branded or tagged with the statement required by law."

Duties of shippers. "It is assumed from correspondence with shippers outside the state that they will register the brands which they sell in Connecticut, will pay analysis fees as has been done in the past by manufacturers of commercial fertilizers, and will semi-annually thereafter pay the tonnage fees.

"They will report to this Station their total sales and if they wish, may report what part has been sold for feed exclusively. From the reports of dealers within the state it will be possible to determine quite closely the amounts of each brand actually used as feed.

"In the case the jobber outside the state neglects or refuses to register a brand, the dealer who sells it within the state is responsible under the law."

Duties of dealers. "Dealers are required to file with the director of the Station on July first of each year and semi-annually thereafter a sworn statement of their total sales of each brand of cottonseed meal and the amount of each sold exclusively for feed, during the preceding six months."

Requirements to be Complied with by Sellers of Commercial Fertilizers.

The seller is responsible for the proper labeling of each package, for the registration at the Station of every brand sold by him and for the payment of the analysis fee, before offering for sale, and annually thereafter on January 1st.

The law specifies the information which shall he given on the label as follows:

1. *Weight of each package in pounds.*
2. *Brand name or trade mark.*
3. *Analysis:*
   - (a) *Available phosphoric acid, per cent.*
   - (b) *Total phosphoric acid, per cent.*
   - (c) *Nitrogen, per cent.*
   - (d) *Equivalent ammonia, per cent.*
   - (e) *Potash soluble in water, per cent.*
4. *Name and address of the manufacturer or of the person who is responsible for the statement of the guaranty.*

In the case of bone meal, tankage or other organic products, and in basic slag and mineral phosphates in which a large percentage of the phosphoric acid is not available hy laboratory methods, the

phosphoric acid shall be claimed as total phosphoric acid unless it is desired to claim available phosphoric acid instead, in which case the guaranty shall take the form set forth above.

The label may be a tag attached to the package or a statement printed thereon. Percentages shall be minimum percentages only.

The presence of leather in its various forms, wool waste, hair, or any inert nitrogenous material shall be declared on the label unless, by processing, the activity of these materials has been rendered satisfactory as determined by official methods.

When potash is derived from sulphate or carbonate of potash it may be so claimed.

No claim or guaranty for less than 0.82 per cent of nitrogen or for less than 1 per cent of phosphoric acid, or for less than 1 per cent of potash shall be regarded in the registration or analysis of any commercial fertilizer.

The seller must also, on the 1st of January and July, report the tonnage of fertilizer sold within the preceding six months and pay to the director of the Station a tonnage fee of 6 cents per ton.

On request, copies of the law and blanks for registration and for tonnage reports will be supplied by the Station.

If, however, proper labeling, registration and payments have been provided for by the manufacturer of the brands or by another responsible person all sellers of such brands are released from the above mentioned requirements. The retailer, therefore, should assure himself that the requirements of the law have been met by the manufacturers of the brands which he handles, or himself be prepared to meet all these requirements.

Precautions to be Observed in Drawing Samples for Analysis.

The analysis of a fertilizer is of no value unless the sample analyzed represents as nearly as possible the stock from which the sample was drawn. The law prescribes the procedure to be followed by authorized agents of this Station when taking official samples for analysis as follows:

"When samples are taken from fertilizers in bags, a tube shall be used, and it shall be inserted at one end of the bag and shall pass substantially the entire length of the bag, so as to take a core of the material being sampled from substantially the entire length of the bag. Samples thus taken from individual bags shall be thoroughly mixed, and the official samples shall be taken from the mixture so drawn by the method known as 'quartering.' Samples of fertilizers taken as herein provided shall be taken from at least five per centum of the separate original unopened packages in the lot, for the mixture from which the official samples shall be taken. If less than one hundred bags are in the lot, at least five bags shall be sampled; if less than five bags, all shall be sampled. Broken packages shall not be sampled."

Gratuitous Analyses.

Under the fertilizer law the Station is charged only with the analysis of samples drawn by its own agents. It does, however each year analyze a considerable number of samples drawn by individuals, representing stock purchased by them for their own use. The object of the purchaser is to satisfy himself as to whether he has obtained goods of the grade represented and perhaps, to obtain evidence upon which to base a claim for shortage should the materials not meet their guaranties. The Station assumes no responsibility for the sampling in case of such unofficial samples and can only vouch for the accuracy of the results obtained on the materials as submitted. Since a representative sample is as essential as an accurate analysis in judging the quality of a shipment of fertilizer, it is evident that a satisfactory adjustment will seldom be effected on the basis of an unofficial sample. Notwithstanding certain objections which may be raised to the practice of analyzing samples submitted by individuals, the Station is disposed to continue such work so long as there is evidence that it constitutes a useful service; it cannot, however, undertake for any one individual or group, work in such volume or with such frequency that it becomes a systematic control over current purchases. This clearly invades the field of the commercial laboratory.

REGISTRATIONS.

Late Registrations for 1925.

To the brands registered for 1925 in our last report should be added:

A. W. Higgins, Inc., South Deerfield, Mass.
Old Deerfield 7-6-6
Old Deerfield 6-10-10

Registrations for 1926.

For 1926, 67 firms and individuals registered at this Station for sale in this State 422 brands of fertilizers. As required by Statute the brands so registered are listed as follows:

American Agricultural Chemical Co., New Haven Sales Dept., New Haven, Conn.
A. A. C. 16% Acid Phosphate
Acme Fertilizer
Aroostook Potato Manure
Castor Pomace
Complete General Fertilizer
Double A Tobacco Fertilizer
Dry Ground Fish

Farmer's Friend Fertilizer
Fine Ground Bone
Gladiator Fertilizer
Grass and Lawn Top Dressing
Hi-Grade Tobacco Manure
Monarch Fertilizer
Muriate of Potash
Nitrate of Soda
Old Hickory Fertilizer
Pulverized Sheep Manure
South American Sheep and Goat Manure
Sulphate of Potash
Bowker's All Round Fertilizer
Bowker's Market Garden Fertilizer
Bowker's Potato and Vegetable Phosphate
Bowker's Sure Crop Fertilizer
Bradley's Blood, Bone and Potash
Bradley's Complete Manure for Potatoes and Vegetables
Bradley's Complete Tobacco Manure
Bradley's Eclipse Fertilizer
Bradley's Northland Potato Grower
Bradley's Potato Fertilizer
Bradley's Potato Manure
Bradley's Superior Tobacco Compound
Bradley's XL Superphosphate of Lime
National Aroostook Special Fertilizer
National Complete Tobacco Fertilizer
National Market Garden Fertilizer
National Pine Tree State Potato Fertilizer
National Premier Potato Manure
National White Ash Tobacco Grower
Sanderson's Atlantic Coast Bone, Fish and Potash
Sanderson's Complete Tobacco Grower
Sanderson's Corn Superphosphate
Sanderson's Formula A
Sanderson's Formula B
Sanderson's Potato Manure
Sanderson's Top Dressing for Grass and Grain
Stockbridge Early Crop Manure
Stockbridge Hill and Drill Fertilizer
Stockbridge Premier Tobacco Grower
Stockbridge Tobacco Manure

American Cyanamid Co., 511 Fifth Avenue, New York, N. Y.

Ammo-Phos

American Linseed Co., 297 Fourth Ave., New York, N. Y.

Alinco Old Process Linseed Meal

Apothecaries Hall Co., Waterbury, Conn.

Acid Phosphate
Animal Tankage
Bone Meal 4-20
Bone Meal 3-22
Bone and Meat Tankage
Carbonate Potash
Castor Pomace

Cotton Seed Meal
Double Sulphate Potash and Magnesia
Dry Ground Fish
Liberty Corn and All Crops
Liberty Corn, Fruit and All Crops
Liberty Fish, Bone and Potash
Liberty High Grade Market Gardeners
Liberty High Grade Tobacco Manure 7-4-7
Liberty Onion Special (Potash as Sulphate)
Liberty Potato and General Crops
Liberty Potato and Market Gardeners' Special
Liberty Potato and Vegetable
Liberty Tobacco Special 5-4-5
Liberty Top Dresser for Grass and Grain
Muriate of Potash
Nitrate of Soda
Nitrate of Soda and Potash
Precipitated Bone
Sulphate Potash

Armour Fertilizer Works, 50 Broad St., New York, N. Y.
Armour's Big Crop Acid Phosphate
Armour's Big Crop Bone Meal
Armour's Big Crop Fertilizer 2-12-4
Armour's Big Crop Fertilizer 3-8-4
Armour's Big Crop Fertilizer 4-8-4
Armour's Big Crop Fertilizer 4-8-7
Armour's Big Crop Fertilizer 4-6-10
Armour's Big Crop Fertilizer 4-16-4
Armour's Big Crop Fertilizer 5-8-7
Armour's Big Crop Fertilizer 8-6-6
Armour's Big Crop Super-Phosphate 20%
Armour's Big Crop Tobacco Special 5-4-5
Armour's Corn Grower
Armour's Muriate of Potash
Armour's Nitrate of Soda
Armour's Sheep Manure
Cotton Seed Meal, 8%
Ground Tankage

Ashcraft-Wilkinson Co., Atlanta, Ga.
Helmet Brand
Monarch Brand
Paramount Brand

Atlantic Packing Co., New Haven, Conn.
Atlantic 4-8-7
Atlantic 5-8-7
Atlantic Grain Fertilizer 2-8-2
Atlantic Potato Phosphate 3-8-4
Atlantic Special Vegetable 4-8-4
Atlantic Tobacco Grower 5-4-5
Atlantic Tobacco Manure 5-8-6
Atlantic 5-4-16

Baker Castor Oil Co., 120 Broadway, New York, N. Y.
Castor Pomace

The Barrett Co., 40 Rector St., New York, N. Y.
Arcadian Sulphate of Ammonia

F. A. Bartlett Tree Expert Co., Stamford, Conn.
Bartlett's Green Tree Food

Berkshire Fertilizer Co., Bridgeport, Conn.
Berkshire Acid Phosphate
Berkshire Castor Pomace
Berkshire Complete Fertilizer
Berkshire Complete Tobacco
Berkshire Dry Ground Fish
Berkshire Economical Grass Fertilizer
Berkshire Fine Ground Bone
Berkshire Grass Special
Berkshire Ground Tankage
Berkshire Long Island Special
Berkshire Market Garden Fertilizer
Berkshire Potato and Vegetable Phosphate
Berkshire Sheep Manure
Berkshire Starter with 10% Potash
Berkshire Tobacco Special
High Grade Sulphate Potash
Muriate Potash
Nitrate of Soda

F. E. Boardman, Middletown, Conn.
Boardman's Fertilizer for Potatoes and General Crops
Boardman's Tobacco Fertilizer

Amos D. Bridge's Sons, Inc., Hazardville, Conn.
Corn, Onion and Potato and General Purpose
Special Tobacco Fertilizer

Buckeye Cotton Oil Co., Cincinnati, Ohio.
Buckeye Cottonseed Meal

A. H. Case & Co., Inc., 965 William St., Buffalo, N. Y.
Case's Brand of Pulverized Sheep Manure

The E. D. Chittenden Co., Bridgeport, Conn.
Acid Phosphate
Castor Pomace
Complete Grain 3% Potash
Dry Ground Fish
Fine Ground Bone
Fine Ground Tankage
High Grade Potato 7% Potash
High Grade Sulphate of Potash
High Grade Tobacco
Muriate of Potash
Nitrate of Soda
Potato Special
Sulphate of Ammonia
Tobacco Special

Everett B. Clark Seed Co., Milford, Conn.
16% Acid Phosphate
Nitrate of Soda
Special Mixture for General Use
Special Mixture with 6% Potash
Super Phosphate
Tip-Top Brand

Conn. Fat Rendering & Fertilizer Corp., West Haven, Conn.
Tankage

Consolidated Rendering Co., 40 North Market St., Boston, Mass.
Acid Phosphate
Castor Pomace
Dry Ground Fish
Ground Bone 2.5-25.18
Ground Bone 3-22.9
Muriate of Potash
Nitrate of Soda
Sulphate of Ammonia
Sulphate of Potash
Tankage 6-30
Tankage 9-20

C. A. Cowles, Plantsville, Conn.
Cowles' Complete Corn and Potato

C. & R. Sales Co., Worcester, Mass.
C. & R. Lawn and Shrub Fertilizer

S. P. Davis, Little Rock, Ark.
Steerboy Brand Cottonseed Meal

Davey Tree Expert Co., Kent, Portage County, Ohio.
Davey Tree Food

Eastern States Farmers' Exchange, 33 Lyman St., Springfield, Mass
Eastern States 3-12-3
Eastern States 4-8-10
Eastern States 5-8-7
Eastern States 5-10-5
Eastern States 8-6-6
Eastern States 8-16-8
Eastern States 8-16-20
Eastern States 10-16-14
Eastern States Acid Phosphate
Eastern States Fine Bone Meal
Eastern States Muriate of Potash
Eastern States Nitrate of Soda
Eastern States Sulphate of Ammonia
Dried Ground Fish
Ground Animal Tankage
Open Formula A Tobacco Fertilizer
Open Formula C Tobacco Fertilizer
Precipitated Bone
Sulphate of Potash

Ed. Eggert, 245 State St., Hartford, Conn.
Cotton Seed Hull Ashes

Essex Fertilizer Co., 39 North Market St., Boston, Mass.
Essex A1 Superphosphate 2-8-2
Essex Complete Manure 5-8-7
Essex Fish Fertilizer For All Crops 3-8-4
Essex Market Garden 4-8-4
Essex Potato Phosphate 4-8-7
Essex Tobacco Grower

Four Seasons Fertilizer Co., Inc., 135 West 29th St., New York, N. Y.
Four Seasons Fertilizer

The L. T. Frisbie Co., New Haven, Conn.
Frisbie's 4-6-10
Frisbie's 5-8-7
Frisbie's Corn and Grain Fertilizer 2-8-2
Frisbie's Fine Bone Meal
Frisbie's 3/50 Bone Meal
Frisbie's Market Garden 4-8-7
Frisbie's Precipitated Bone
Frisbie's Special 3-8-4
Frisbie's Special Vegetable and Potato Grower 4-8-4
Frisbie's Tobacco Grower 5-4-5
Frisbie's Tobacco Manure 5-8-6
Frisbie's Top Dresser 7-6-5

Harris & Co., Portland, Ore.
"Merino" Brand Ground Sheep Manure

A. W. Higgins, Inc., South Deerfield, Mass.
Old Deerfield 3-10-6
Old Deerfield 4-8-4
Old Deerfield 5-8-7
Old Deerfield 7-4-7
Old Deerfield Acid Phosphate
Old Deerfield 10-16-14 Concentrated Fertilizer

Humphreys-Godwin Co., Memphis, Tenn.
Bull Brand
Danish Brand
Dixie Brand

International Agricultural Corp., 126 State St., Boston, Mass.
International Acid Phosphate
International Connecticut Valley Special
International Crop Grower
International Economy
International General Favorite
International High Grade Manure
International Ideal
International Multiple-Strength 8-12-20
International New England Special
International Phosphate and Potash
International Tobacco Producer

I. A. C. Top Dresser and Starter
Bone Meal
Castor Pomace
Cotton Seed Meal
Nitrate of Soda
Precipitated Bone
Sulphate of Potash
Tankage

John Joynt Co., Inc., Lucknow, Ontario, Canada.
The Joynt Brand Unleached Hardwood Ashes

Spencer Kellogg & Sons, Inc., Buffalo, N. Y.
Castor Pomace

King Chemical Co., Inc., Bound Brook, N. J.
King Acid Phosphate

Kuttroff, Pickhardt & Co., Inc., New York, N. Y.
Floranid (Urea B. A. S. F.)

L. B. Lovitt & Co., Memphis, Tenn.
"Lovit Brand" 43% Cotton Seed Meal

Lowell Fertilizer Co., 40 North Market St., Boston, Mass.
Lowell Animal Brand A High Grade Manure For All Crops 3-8-4
Lowell Bone Fertilizer 2-8-2
Lowell Corn and Vegetable 4-8-4
Lowell Market Garden Manure 5-8-7
Lowell Potato Grower 4-6-10
Lowell Potato Phosphate 4-8-7
Lowell Tobacco 5-4-5
Lowell Top Dressing 7-6-5

The Mapes Formula & Peruvian Guano Co., 270 Madison Ave., New York, N. Y.
The Mapes Connecticut Valley Special
The Mapes Corn Manure
The Mapes General Tobacco Manure
The Mapes General Truck Manure
The Mapes General Use Manure
The Mapes Grain Brand
The Mapes Onion Manure
The Mapes Potato Manure
The Mapes Special Formula Tobacco Manure
The Mapes Special Trucker
The Mapes Tobacco Ash Constituents
The Mapes Tobacco Manure, Wrapper Brand
The Mapes Tobacco Starter, Improved
The Mapes Top Dresser
Cotton Seed Meal
Nitrate of Soda
Pure Fine Ground Bone
Sulphate of Potash

Mehmel & Sarvi, Plantsville, Conn.
Mehmel's Corn, Potato and Onion Fertilizer

Memphis Cottonseed Products Co., Memphis, Tenn.
Durham Thirty-Six Cottonseed Meal

Natural Guano Co., Aurora, Ill.
"Sheep's Head" Pulverized Sheep Manure

R. N. Neal & Co., Memphis, Tenn.
"Triangle" Brand 43% Cottonseed Meal

N. E. By-Products Corp., 20 West St., Lawrence, Mass.
Pure Bone Meal

New England Fertilizer Co., 40A North Market St., Boston, Mass.
New England Corn Phosphate 2-8-2
New England Market Garden Manure 5-8-7
New England Potato Phosphate 4-8-7
New England Potato and Vegetable Manure 4-8-4
New England Superphosphate A High Grade Fertilizer For All Crops 3-8-4
New England Tobacco Manure 5-4-5

Olds & Whipple, Inc., Hartford, Conn.
O & W Acid Phosphate
O & W Castor Pomace
O & W Complete Market Garden Fertilizer
O & W Complete Tobacco Fertilizer
O & W Dry Ground Fish
O & W Grain and General Crop Fertilizer
O & W Grass Fertilizer
O & W High Grade Starter and Potash Compound
O & W High Grade Tobacco Starter
O & W High Grade Vegetable and Potato Fertilizer
O & W Nitrate of Soda
O & W Precipitated Bone
O & W Pure Bone Meal
O & W Tobacco Starter, Blue Label Brand
Double Manure Salts
High Grade Sulphate of Potash

Pacific Manure & Fertilizer Co., 429 Davis St., San Francisco, Cal.
Grozit (Pulverized Sheep Manure)

Parmenter & Polsey Fertilizer Co., 41 North Market St., Boston, Mass.
"P & P" Maine Potato Fertilizer 4-6-10
"P & P" Plymouth Rock Brand For All Crops 3-8-4

Piedmont-Mt. Airy Guano Co., Baltimore, Md.
Harvest Brand 2-8-2
Harvest Brand 3-8-4
Harvest Brand 4-6-10
Harvest Brand 4-8-4
Harvest Brand 5-8-7

Harvest Brand 6-8-6
Harvest Brand 8-6-6
Harvest Brand 16%
Muriate Potash
Nitrate of Soda
Steam Bone

Frank S. Platt Co., 450 State St., New Haven, Conn.
Platco Special 5-8-7

Premier Poultry Manure Co., 431 South Dearborn St., Chicago, Ill.
Premier Brand Poultry Manure
Premier Brand Sheep Manure

The Pulverized Manure Co., 828 Exchange Ave., Chicago, Ill.
Wizard Brand Manure
Wizard Brand Sheep Manure

Rackliffe Brothers Co., Inc., New Britain, Conn.
Rackliffe Brand 4-8-4
Rackliffe Brand 5-8-7
Rackliffe Brand Nitrate of Soda 18%

The Rogers & Hubbard Co., Portland, Conn.
Rogers & Hubbard's All Soils—All Crops Fertilizer
Rogers & Hubbard's Climax Tobacco Brand
Rogers & Hubbard's Corn and Grain Fertilizer
Rogers & Hubbard's High Potash Fertilizer
Rogers & Hubbard's Potato Fertilizer
Rogers & Hubbard's Tobacco Grower, Vegetable Formula
Hubbard's "Bone Base" Oats and Top Dressing
Hubbard's "Bone Base" Fertilizer for Seeding Down
Hubbard's "Bone Base" Soluble Corn and General Crops Manure
Hubbard's "Bone Base" Soluble Potato Manure
Hubbard's "Bone Base" Soluble Tobacco Manure
Hubbard's Pure Raw Knuckle Bone Flour
Hubbard's Strictly Pure Fine Bone
5-8-7
4-8-4
10-3-8
Acid Phosphate
Castor Pomace
Garden Fertilizer
Muriate of Potash
Nitrate of Soda
Tankage

F. S. Royster Guano Co., 602 Citizens National Bank Bldg., Baltimore, Md.
Royster's 16% Acid Phosphate
Royster's Fine Ground Bone Meal
Royster's Gem Guano
Royster's Quality Trucker
Royster's Rational Guano
Royster's Spearhead Guano
Royster's Top Dresser
Royster's Trucker's Delight

Royster's 5% Truck Guano
Royster's Valley Tobacco Formula
Nitrate of Soda
Sulphate of Ammonia

M. L. Shoemaker & Co., Inc., Venango St. and Delaware Ave., Philadelphia, Pa.
Shoemaker's "Swift-Sure" 16% Acid Phosphate
Shoemaker's "Swift-Sure" Bone Meal
Shoemaker's "Swift-Sure" Crop Grower
Shoemaker's "Swift-Sure" Special Tobacco Formula
Shoemaker's "Swift-Sure" Super Phos. Potato Special
Shoemaker's "Swift-Sure" Tobacco and General Use
Shoemaker's "Swift-Sure" Tobacco Starter

Springfield Rendering Co., Springfield, Mass.
Springfield Animal Brand 3-8-4
Springfield 4-8-7
Springfield Market Garden Grower and Top Dresser 5-8-7
Springfield Special Potato, Onion and Vegetable 4-8-4
Springfield Tobacco Special 5-4-5

I. P. Thomas & Son Co., 1000 Drexel Bldg., Philadelphia, Pa.
16% Acid Phosphate
Castor Pomace
Economy Fertilizer
High Grade Potato Manure
I. P. Thomas 5-8-7
Long Island Special
Muriate of Potash
Nitrate of Soda
Pure Ground Bone
Sulphate of Potash
7% Guano
Tankage
Thomas' Fish and Potash
Truckers' High-Grade
Thomas' Tobacco Grower (Sulphate of Potash)
Tip Top Super-Phosphate
Victor Potash Fertilizer

Triton Oil & Fertilizer Co., 101 Beekman St., New York, N. Y.
Triton 4-8-4 Fertilizer
Triton 4-8-7 Fertilizer

U. S. Fertilizer Chemical Co., Inc., 85 E. 10th St., New York, N. Y.
Volco Ideal

United States Guano Co., Baltimore, Md.
Standard United States 16% Acid Phosphate
Standard United States Bone Meal
Standard United States Evergreen Fish Guano
Standard United States Fish, Bone and Potash
Standard United States Mammoth Potato Grower
Standard United States Muriate of Potash
Standard United States Nitrate of Soda
Standard United States Old Fertility

Standard United States Royal Potato Grower
Standard United States 3-9-2
Standard United States 5-4-5
Standard United States 5-8-5

Virginia-Carolina Chemical Co. (of Delaware), 120 Broadway, New York, N. Y.

V-C *Aroostook* Potato Grower
V-C Double Owl Brand
V-C Rescue Brand
V-C Super-Thirty
Nitrate of Soda

Wilcox Fertilizer Co., Mystic, Conn.

Wilcox 5-8-7 Fertilizer
Wilcox 5-10-5 Fertilizer
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox *Fish and* Potash (1924-25 Formula 4-8-4)
Wilcox Potato and Vegetable Phosphate
Wilcox Special 4-8-4 Fertilizer
Wilcox 7-6-5 Top Dresser
Acid Phosphate
Ground Blood and Meat Tankage
Ground Steamed Bone
Muriate of Potash
Nitrate of Soda

Wilson-Martin Co., Philadelphia, Pa.

Bantle's Wrapper Brand

S. D. Woodruff & Sons, Orange, Conn.

Woodruff's Home Mixed Fertilizer

Worcester Rendering Co., Auburn, Mass.

Prosperity Brand Complete Dressing
Prosperity Brand Corn and Grain Fertilizer
Prosperity Brand Market Garden Fertilizer
Prosperity Brand Potato and Vegetable Fertilizer

Wm. P. Young & Son, 22-24 High St., Pottstown, Montgomery Co., Pa.

Acid Phosphate
Ammonium Sulphate
Muriate of Potash

INSPECTION OF 1926.

During the year the Station inspector has visited 86 towns and villages in the State and drawn 540 official samples, representing all the registered brands which were found on sale. These together with samples submitted by purchasers, or others interested, may be classified as follows:

CLASSIFICATION OF FERTILIZERS ANALYZED IN 1926.

		Number of Samples	Page
I.	*Containing Nitrogen as the chief active ingredient:*		
	Nitrate of Soda	31	18
	Sulphate of Ammonia	7	21
	Castor Pomace	44	22
	Cottonseed Meal	134	26
	Linseed Meal	7	26
II.	*Containing Phosphoric Acid as the chief active ingredient:*		
	Precipitated Bone Phosphate	8	33
	Dissolved Rock Phosphate or Acid Phosphate	21	35
III.	*Containing Potash as the chief ingredient:*		
	Carbonate of Potash	11	37
	Muriate of Potash	12	37
	Sulphate of Potash	10	37
	Sulphate of Potash-Magnesia	2	38
	Cotton Hull Ashes	3	38
IV.	*Containing Nitrogen and Potash:*		
	Nitrate of Potash and Soda	5	42
	Nitrate of Potash	1	42
V.	*Containing Nitrogen and Phosphoric Acid:*		
	Dry Ground Fish	18	43
	Tankage	16	46
	Ground Bone	30	46
VI.	*Mixed Fertilizers:*		
	Containing Nitrogen and Phosphoric Acid	3	50
	Containing Nitrogen, Phosphoric Acid and Potash	253	50
	Special and Home Mixtures	64	74
VII.	*Miscellaneous fertilizers, amendments, waste products, etc.:*		
	Wood Ashes	20	80
	Sheep Manure, etc.	12	81
	Lime, etc.	16	81
	Miscellaneous	61	89
	Total	789	

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

Nitrate of Soda is obtained from the west coast of South America, chiefly in Chili. Commercial grades of the salt contain from 91 to 97 per cent of sodium nitrate equivalent to from 15 to 16 per cent of nitrogen.

Thirty-one samples, twenty-three of which were drawn officially by the Station, were examined. Twenty-nine equalled or exceeded their guaranties. Sample **3812** showed the only notable deficiency, but a second sample from another source was not deficient.

Prices, based upon ten quotations, have ranged from $64.00 to $85.00 per ton, the average being about $72.00. Nitrogen from this source has cost on an average about 24 cents per pound.

Analyses are given in Table I.

OTHER CONCENTRATED AMMONIATES.

There is an increasing interest, both on the part of manufacturers and growers, in some of the newer raw materials which supply nitrogen in concentrated form. Field experience with some of these products is limited, but so far as they have been tried in this State and elsewhere they have produced generally good results. Director Slate has recently discussed[1] some of these newer ammoniates.

Calcium Cyanamide. This is an air-nitrogen product which has been manufactured in this country for some years, and is relatively cheap. The Muscle Shoals plant is designed to produce it. The commercial article usually contains 20 to 25 per cent of nitrogen, equivalent to 25 to 30 per cent of ammonia. For fertilizer purposes this form of nitrogen is regarded as of organic nature. It is rather slowly available in the soil and should be applied some time before planting seed. It cannot be used in large quantity in mixed goods containing acid phosphate.

Ammonium Nitrate. This salt, formerly made from nitric acid and ammonia, is now made more cheaply in Europe from air nitrogen. The commercial article contains about 41 per cent of ammonia. It leaves no residue in the soil and has given good results on crops so far as it has been tried. It tends to become moist on storage.

Ammonium Chloride. (Muriate of Ammonia.) This salt contains about 26 per cent of nitrogen equivalent to about 31 per cent of ammonia. It is seldom used in fertilizers because of

[1] Farmers' Week, Conn. Agr. College, August, 1926.

s relatively high cost. It is being used to some extent in Europe, owever, for such purpose.

Urea. This is a recent commercial product and is the most oncentrated of the newer ammoniates. It contains about 45 per ent of nitrogen, equivalent to 55 per cent of ammonia, and is iade by a new process directly from ammonia and carbon dioxide. : leaves no residue in the soil and equals nitrate of soda in availbility.

"Leuna" Saltpeter. This is a double salt, ammonium sulphateitrate, containing 26 per cent of nitrogen of which about ¼ is itrate nitrogen and ¾ is ammonia nitrogen. It is hygroscopic ut a product claimed to be drillable is being offered.

Other raw materials which supply both nitrogen and phoshoric acid are being offered. Of these may be mentioned the ollowing:

Ammonium Phosphate. (Ammo-Phos.) This salt is being roduced in this country and contains about 14 per cent of amonia and 45 per cent of phosphoric acid. It has given good esults as a fertilizer where tried.

Urea Phosphate. It contains 21 per cent of ammonia and 45 er cent of phosphoric acid. Its physical condition is satisfactory nd, so far as tried, has given good results in the field.

TABLE I. ANALYSES OF NITRATE OF SODA.

	Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cen[t] Nitroge[n] Found.	
52	American Agricultural Chemical Co., New York	Station agent. Stock of Bristol Grain & Supply Co., Bristol	15.04	1
86	Armour Fertilizer Works, New York	Station agent. Stock of Harrison & Gould, Milford	15.12	1
50	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	15.34	1
05	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	15.50	1
48	Apothecaries Hall Co., Waterbury	Station agent. Stock of J. A. Glasnap, West Cheshire	14.90	1
42	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	15.08	1
51	Apothecaries Hall Co., Waterbury	American Sumatra Tobacco Co., Bloomfield	15.70	1
92	Berkshire Fertilizer Co., Bridgeport	Station agent. Stock of Gabriel Dadio, Highwood	15.20	1
00	Berkshire Fertilizer Co., Bridgeport	Station agent. Stock of E. N. Austin, Suffield	15.76	1
16	E. D. Chittenden Co., Bridgeport	Station agent. Stock of E. J. Bantle, Glastonbury	15.54	1
4	E. B. Clark Seed Co., Milford	Station agent. Stock of G. R. Russell, Branford	15.20	1
14	Consolidated Rendering Co., Boston	Station agent. Stock of L. T. Frisbie Co., New Haven	15.50	1
7	Consolidated Rendering Co., Boston	Station agent. Stock of Cheshire Reformatory, Cheshire	15.28	1
9	Eastern States Farmers' Exchange, Springfield	Station agent. Stock of John Swan, Seymour	15.46	1
9	International Agricultural Corp., Boston	Station agent. Stock of Mehmel & Sarvi, Plantsville	15.52	1
6	Mapes Formula & Peruvian Guano Co., New York	Station agent. Stock of Mapes Branch, Hartford	15.46	1
9	Olds & Whipple, Inc., Hartford	Station agent at factory	15.06	1
7	Olds & Whipple, Inc., Hartford	John M. Herr, Burnside	15.76	15
8	Piedmont-Mt. Airy Guano Co., Baltimore	Station agent. Stock of Seymour Grain & Coal Co., Seymour	15.44	15
2	Rackliffe Bros. Co., New Britain	Station agent at factory	15.60	14
4	The Rogers & Hubbard Co., Portland	Station agent at factory	15.42	14
8	The Rogers & Hubbard Co., Portland	Station agent. Stock of E. M. Wooding, North Haven	14.84	14

TABLE I. ANALYSES OF NITRATE OF SODA—*Concluded.*

Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
F. S. Royster Guano Co., Baltimore	Station agent. Stock of Hitchcock Hardware Co., Watertown	14.00	15.
F. S. Royster Guano Co., Baltimore	Station agent. Stock of F. B. Newton, Plainville	15.64	15.
I. P. Thomas & Son, Philadelphia	Station agent. Stock of L. B. Wooding, North Haven	15.46	15.
United States Guano Co., Baltimore	Station agent. Stock of F. W. Wadhams, Torrington	15.64	15.
Virginia-Carolina Chemical Co., New York	Station agent. Stock of E. O. Chapman, North Haven	15.96	14.
The Wilcox Fertilizer Co., Mystic	Daigle Bros., Marion	15.22	15.
The Wilcox Fertilizer Co., Mystic	Station agent at factory	15.48	15.
38561	American Sumatra Tobacco Co., Bloomfield	15.78	..
36151	American Sumatra Tobacco Co., Bloomfield	15.98	..

AMMONIUM SULPHATE.

Ammonium sulphate is chiefly derived as a by-product in the process of manufacturing coke and illuminating gas. The ammonia liquor is distilled over lime, the free ammonia conducted into dilute sulphuric acid and the ammonium sulphate thus formed is separated and dried.

Commercial grades of this raw material contain about 20.5 per cent of nitrogen which is equivalent to 25 per cent of ammonia.

Seven samples were examined all of which equalled or exceeded the guaranties so far as given. All contained over 20.5 per cent of nitrogen, the average being 20.78 per cent.

The price per ton was quoted in only one instance which was $78.00. On this basis the cost per pound of nitrogen is about 18.8 cents. Last year the cost per pound as calculated ranged from 9.8 to 19.3 and averaged 16.6 cents.

Analyses are given in Table II.

TABLE II. ANALYSES OF SULPHATE OF AMMONIA.

Station No.	Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cer Nitroge	
			Found.	
3665	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	20.90	
3753	The Barrett Co., New York	Station agent. Stock of Olds & Whipple, Inc., Hartford	20.76	2
3926	The Barrett Co., New York	Daigle Bros., Marion	20.86	2
4235	E. D. Chittenden Co., Bridgeport	Station agent. Stock of E. J. Bantle, Glastonbury	20.72	2
3882	Consolidated Rendering Co., Boston	Station agent. Stock of Geo. S. Jennings, Southport	20.86	2
4400	Eastern States Farmers' Exchange, Springfield	Station agent. Stock of H. H. Tomlinson, Bethany	20.80	2
4085	F. S. Royster Guano Co., Baltimore	Station agent. Stock of W. S. Brown, Trumbull	20.56	2

CASTOR POMACE.

Castor pomace is the residue left after removing the oil from the castor bean. It is poisonous to stock and should be kept away from farm animals. It is chiefly valuable in fertilizer mixtures as a source of nitrogen but contains also about one per cent of potash and two per cent of phosphoric acid.

Forty-four samples were analyzed and in only three instances were there any considerable deficiencies in nitrogen, these being 0.17, 0.27 and 0.37 per cent.

Generally this material is sold on a guaranty of about 4.50 per cent nitrogen equivalent to 5.50 per cent of ammonia.

The average nitrogen content found this year is about 5.1 per cent. Last year it was 4.75 per cent.

Prices have ranged from $23.00 to $30.00 per ton and averaged $26.00. If allowance is made for the phosphoric acid and potash present, nitrogen in this material has cost 23.2 cents per pound.

Analyses are given in Table III.

TABLE III. ANALYSES OF CASTOR POMACE.

Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
The American Agricultural Chemical Co., New York City.			
....	Station agent at factory, New Haven	4.86	4.53
N. H. 73174	Spencer Bros., Inc., Suffield	5.08	4.52
Apothecaries Hall Co., Waterbury, Conn.			
....	Station agent at factory, East Windsor	5.34	4.52
....	American Sumatra Tobacco Co., Bloomfield	5.26	4.52
566905	Hatheway & Steane, Inc., Hartford	6.01	4.52
38937	Hatheway & Steane, Inc., Hartford	5.13	4.52
61864	Hatheway & Steane, Inc., Hartford	5.26	4.52
66419	Hatheway & Steane, Inc., Hartford	6.11	4.52
20569	Hatheway & Steane, Inc., Hartford	5.73	4.52
11653	Hatheway & Steane, Inc., Hartford	4.25	4.52
44941	Hatheway & Steane, Inc., Hartford	5.38	4.52
83827	Hatheway & Steane, Inc., Hartford	4.91	4.52
46448	Hatheway & Steane, Inc., Hartford	5.16	4.52
....	Paul & Ed. Rostek, Melrose	4.98	4.52
Ashcraft-Wilkinson Co., New York City.			
Erie 88563	Spencer Bros., Inc., Suffield	5.02	4.52
Baker Castor Oil Co., New York City.			
35751	American Sumatra Tobacco Co., Bloomfield	4.49	4.50
98052	American Sumatra Tobacco Co., Bloomfield	4.91	4.50
83959	American Sumatra Tobacco Co., Bloomfield	5.01	4.50

TABLE III. ANALYSES OF CASTOR POMACE—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Baker Castor Oil Co., New York City.			
4434	....	Station agent, from stock of Apothecaries Hall Co., Waterbury	5.37	4.
4670	....	Station agent, from stock of J. H. Reardan, South Windsor	5.06	4.
	Berkshire Fertilizer Co., Bridgeport, Conn.			
2691	....	J. E. Phelps, Suffield	6.35	4.
2692	....	J. E. Phelps, Suffield	5.20	4.
3788	....	Station agent at factory	4.81	4.
3824	N. Y. C. 220049	Spencer Bros., Inc., Suffield	4.74	4.
4095	N. Y. C. 244751	Spencer Bros., Inc., Suffield	5.10	4.
4298	....	Station agent, from stock of E. N. Austin, Suffield	4.15	4.
4691	....	Station agent, from stock of Manning & Kahn, Manchester	5.50	4.
	E. D. Chittenden Co., Bridgeport, Conn.			
3932	....	Allied Tobacco Co., Hartford	4.78	4.
4456	....	Station agent, from stock of Allied Tobacco Co., Hartford	5.45	4.
4214	....	Station agent, from stock of E. J. Bantle, Glastonbury	5.29	4.
	***Consolidated Rendering Co.,* Boston, Mass.**			
4488	....	Station agent, from stock of Mrs. Frank Bantle, Glastonbury	4.35	4.
	International Agricultural Corp., Boston, Mass.			
4647	....	Station agent, from stock of James T. Caffrey, Cromwell	4.64	4.
	Spencer Kellogg & Sons, Inc., Edgewater, N. J.			
4256	....	Richard P. Jones, South Windsor	5.38	4.
4288	....	Station agent, from stock of E. J. Bantle, Glastonbury	5.39	4.

TABLE III. ANALYSES OF CASTOR POMACE—*Concluded.*

Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
Olds & Whipple, Inc., Hartford, Conn.			
....	Station agent at factory	5.56	5.00
....	R. C. Futtner, Burnside	5.30	5.00
....	R. C. Futtner, Burnside	5.50	5.00
The Rogers & Hubbard Co., Portland, Conn.			
....	Station agent, from stock of John Heller, Glastonbury	4.98	4.75
I. P. Thomas & Son, Philadelphia, Pa.			
....	Station agent, from stock of L. M. Benham, Highwood	5.03	4.50
Manufacturer Unknown.			
13105	American Sumatra Tobacco Co., Bloomfield	4.38	....
36179	American Sumatra Tobacco Co., Bloomfield	4.66	....
17155	American Sumatra Tobacco Co., Bloomfield	4.51	....
Long Island 3343	L. T. Frisbie Co., New Haven ...	4.56	....
Long Island 3345	L. T. Frisbie Co., New Haven ...	4.56	....

COTTONSEED MEAL.

One hundred and thirty-four samples of cottonseed meal have been examined. This number includes official samples and those submitted by purchasers.

The classification of samples and the average nitrogen found in each group are given in the following summary:

Grade	No. of Samples.	Average Nitrogen. %
36 per cent protein (5.76 N)	15	5.84
41 per cent protein (6.58 N)	68	6.60
43 per cent protein (6.88 N)	39	6.78
Odd per cent	1	...
No guaranty	11	6.64

Of one hundred and twenty-three samples with guaranties given, ninety-four exceeded, or substantially met, such guaranties and twenty-nine did not. In the 43 per cent protein group the guaranty of 6.88 per cent nitrogen was not maintained on an average.

The range in price based upon 57 quotations has been from $33.50 to $46.00 per ton and the average about $41.00. On the basis of these figures nitrogen from this source has, therefore, cost about 31.2 cents per pound.

Analyses are given in Table IV.

LINSEED MEAL.

Seven samples of linseed meal were analyzed. All fully satisfied their guaranties.

Analyses are given in Table IV.

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS.

Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
Apothecaries Hall Co., Waterbury, Conn.	**Cottonseed Meal.**		
....	Station agent at factory, East Windsor	6.57	6.58
Dixie, 48490	Hatheway & Steane, Inc., Hartford	7.05	6.58
Dixie, 33170	Hatheway & Steane, Inc., Hartford	6.74	6.58
Dixie, 35626	Hatheway & Steane, Inc., Hartford	5.82	6.58
Dixie, 47807	Hatheway & Steane, Inc., Hartford	6.46	6.58
Dixie, 342828	Hatheway & Steane, Inc., Hartford	7.16	6.58
Dixie, 174285	Hatheway & Steane, Inc., Hartford	7.26	6.58
Dixie, 48419	Hatheway & Steane, Inc., Hartford	7.15	6.58
Dixie, 173264	Hatheway & Steane, Inc., Hartford	7.37	6.58
Dixie, 120080	Hatheway & Steane, Inc., Hartford	7.07	6.58
Dixie, 79787	Hatheway & Steane, Inc., Hartford	6.96	6.58
Dixie, 47914	Hatheway & Steane, Inc., Hartford	6.50	6.58
Dixie, 16559	Hatheway & Steane, Inc., Hartford	6.58	6.58
Dixie, 3700	Hatheway & Steane, Inc., Hartford	7.21	6.58
Dixie, 72756	Hatheway & Steane, Inc., Hartford	6.89	6.58
249236 (Off Color)	A. N. Shepard & Son, Hartford ..	6.80	....
94045	A. N. Shepard & Son, Hartford ..	6.90	....
Dixie (Dark)	Mrs. H. Hartz, Burnside	6.55	6.58
Dixie	Allied Tobacco Co., Hartford ...	6.94	6.58
Dixie (Brown), 158334	C. D. Cannon, Windsor Locks ...	6.56	6.58
Dixie (Brown), P. M. 24109.	C. D. Cannon, Windsor Locks ...	6.66	6.58
Ashcraft-Wilkinson Co., Atlanta, Ga.			
Paramount	Station agent, from stock of W. E. Fisk, Warehouse Point	5.65	5.75
Monarch	Station agent, from stock of Geo. E. Ackley Co., New Milford ...	7.17	6.88

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per ce[nt] Nitrog[en] Found.
		Cottonseed Meal.	
	Ashcraft-Wilkinson Co., Atlanta, Ga.		
4160	Helmet	Station agent, from stock of Geo. E. Ackley Co., New Milford	6.28
4163	Paramount	Station agent, from stock of Geo. S. Phelps & Co., Thompsonville	5.77
3412	39180	American Sumatra Tobacco Co., Bloomfield	7.00
3413	27601	American Sumatra Tobacco Co., Bloomfield	6.69
3517	Helmet, 166167	American Sumatra Tobacco Co., Bloomfield	6.50
3561	48229	American Sumatra Tobacco Co., Bloomfield	6.95
3590	Helmet, 51314	American Sumatra Tobacco Co., Bloomfield	6.68
3591	Helmet, 57021	American Sumatra Tobacco Co., Bloomfield	6.54
3592	Helmet, 25976	American Sumatra Tobacco Co., Bloomfield	6.62
3593	Helmet, 41782	American Sumatra Tobacco Co., Bloomfield	6.26
3594	Helmet, 48303	American Sumatra Tobacco Co., Bloomfield	6.92
3595	Helmet, 95016	American Sumatra Tobacco Co., Bloomfield	6.65
3596	Helmet, 85816	American Sumatra Tobacco Co., Bloomfield	6.72
3597	Helmet, 94627	American Sumatra Tobacco Co., Bloomfield	6.58
3598	Helmet, 340761	American Sumatra Tobacco Co., Bloomfield	7.02
3599	Helmet, 1272	American Sumatra Tobacco Co., Bloomfield	6.74
3600	Helmet, 164431	American Sumatra Tobacco Co., Bloomfield	6.28
3601	Helmet, 518489	American Sumatra Tobacco Co., Bloomfield	6.69
3602	Helmet, 155380	American Sumatra Tobacco Co., Bloomfield	7.13
3603	Helmet, 7692	American Sumatra Tobacco Co., Bloomfield	6.27
4522	Helmet, 75283	American Sumatra Tobacco Co., Bloomfield	6.29

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
Ashcraft-Wilkinson Co., Atlanta, Ga.	**Cottonseed Meal.**		
Helmet, 12005	American Sumatra Tobacco Co., Bloomfield	6.88	6.58
Helmet, 8159	American Sumatra Tobacco Co., Bloomfield	6.47	6.58
Helmet, 104117	American Sumatra Tobacco Co., Bloomfield	6.92	6.58
Helmet, 265774	American Sumatra Tobacco Co., Bloomfield	7.00	6.58
Helmet, 170170	American Sumatra Tobacco Co., Bloomfield	6.42	6.58
Paramount, S. A. L. 80784	The Coles Company, Middletown	6.28	5.75
Helmet, A. C. L. 36329	Spencer Bros., Inc., Suffield	6.58	6.58
Helmet, C. of Ga. 50302	Spencer Bros., Inc., Suffield	6.82	6.58
Monarch, I. G. N. 9357	Spencer Bros., Inc., Suffield	7.06	6.88
Monarch, C. N. W. 114738	Spencer Bros., Inc., Suffield	7.02	6.88
Monarch, C. of Ga. 60227	Spencer Bros., Inc., Suffield	6.98	6.88
Monarch, C. C. C. 53209	Spencer Bros., Inc., Suffield	7.02	6.88
Paramount, B. & O. 174135	Spencer Bros., Inc., Suffield	5.90	5.75
Paramount, I. C. 755930	Spencer Bros., Inc., Suffield	5.69	5.75
Paramount, I. C. 162238	Spencer Bros., Inc., Suffield	5.64	5.75
Paramount, C. of Ga. 55546	Spencer Bros., Inc., Suffield	5.73	5.75
Paramount, R. D. G. 18086	Spencer Bros., Inc., Suffield	6.18	5.75
Paramount, N. Y. C. 243230	Spencer Bros., Inc., Suffield	5.76	5.75
Paramount, L. & N. 101250	Spencer Bros., Inc., Suffield	5.83	5.75
Paramount, C. of Ga. 55505	Spencer Bros., Inc., Suffield	5.89	5.75
Paramount, C. of Ga. 56730	Spencer Bros., Inc., Suffield	5.72	5.75
Buckeye Cotton Oil Co., Little Rock, Ark.			
....	Station agent, from stock of E. J. Bantle, Glastonbury	6.66	6.58
S. P. Davis, Little Rock, Ark.			
Steerboy	Amos D. Bridge's Sons, Inc., Hazardville	7.00	6.88
Humphreys-Godwin Co., Memphis, Tenn.			
101674	American Sumatra Tobacco Co., Bloomfield	6.44	....
Bull	Station agent, from stock of E. N. Austin, Suffield	6.77	6.88

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
		Cottonseed Meal.		
	Humphreys-Godwin Co., Memphis, Tenn.			
3399	Dixie, I. & Gn. 6172	L. B. Hass & Co., Hartford	6.87	6.5
3400	Dixie, N. P. 130268	L. B. Hass & Co., Hartford	6.82	6.5
3401	Dixie, McP. 120063	L. B. Hass & Co., Hartford	7.07	6.5
4776	Bull	John M. Herr, Burnside	6.46	6.8
4528	Dixie, C. B. & Q. 131429	H. C. Nelson, West Suffield	6.58	6.5
4690	Dixie	Station agent, from stock of J. P. Norton, Broad Brook	7.02	6.5
4426	Bull	Edward Perkins, Suffield	6.68	6.8
2690	Dixie	J. E. Phelps, Suffield	6.88	6.5
3997	Bull, A. T. S. F. 46689	Geo. S. Phelps & Co., Thompsonville	6.91	6.8
4398	Dixie	J. E. Phelps & Co., Suffield	6.55	6.5
4470	Danish	Station agent, from stock of Geo. S. Phelps & Co., Thompsonville	5.85	5.[illegible]
4041	Bull, N. Y. 88340 & S. P. 34627	Spencer Bros., Inc., Suffield	6.55	6.8
4042	Bull, S. S. W. 31194	Spencer Bros., Inc., Suffield	7.06	6.8
4043	Dixie, G. N. 11653	Spencer Bros., Inc., Suffield	6.55	6.5
4044	Dixie, N. K. P. 18488	Spencer Bros., Inc., Suffield	6.92	6.5
4096	Bull, N. Y. 77092 & T. P. 31149	Spencer Bros., Inc., Suffield	6.88	6.8
4097	Bull, I. C. 172572	Spencer Bros., Inc., Suffield	7.02	6.8
4263	Danish. A. C. L. 29150	Spencer Bros., Inc., Suffield	5.62	5.[illegible]
4264	Bull, W. of A. 977	Spencer Bros., Inc., Suffield	6.87	6.8
4265	Bull, N.Y. 87441 & I.N.O. 52782	Spencer Bros., Inc., Suffield	6.79	6.8
4266	Bull, N.Y. 72768 & S.S.W. 65341	Spencer Bros., Inc., Suffield	7.09	6.8
4267	Bull, N.Y. 76082 & S.L.S.F. 150102	Spencer Bros., Inc., Suffield	7.12	6.8
4268	Bull, M.P. 35512 (Brown)	Spencer Bros., Inc., Suffield	6.77	6.8
4269	Bull, N.Y. 80550 & S.L.S.F. 150352	Spencer Bros., Inc., Suffield	7.21	6.8
4270	Bull (Brown), N. P. 48461	Spencer Bros., Inc., Suffield	6.82	6.8
4460	Bull	Station agent, from stock of Spencer Bros., Inc., Suffield	7.01	6.8
4461	Dixie	Station agent, from stock of Spencer Bros., Inc., Suffield	6.59	6.5
4562	Bull, N.Y. 75574 & S.F. 20711	Spencer Bros., Inc., Suffield	6.90	6.8
4563	Bull, N.Y. 89758 & S.P. 22956	Spencer Bros., Inc., Suffield	6.79	6.8
4564	Bull, B.&M. 66509 & S.P. 27875	Spencer Bros., Inc., Suffield	6.79	6.8
4565	Bull, N.Y. 70254 & S.P. 31139	Spencer Bros., Inc., Suffield	6.74	6.8
3388	Dixie, D. L. & W. 39450	Steane, Hartman & Co., Hartford	6.92	6.5
3389	Dixie, M. O. P. 38817	Steane, Hartman & Co., Hartford	6.72	6.5
3391	Dixie, J. G. & N. 164182	Steane, Hartman & Co., Hartford	6.87	6.5
3392	Dixie, S. S. W. 24574	Steane, Hartman & Co., Hartford	6.94	6.5
3393	Dixie, Southern 337394	Steane, Hartman & Co., Hartford	6.81	6.5

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
		Cottonseed Meal.		
	Humphreys-Godwin Co., Memphis, Tenn.			
3394	Dixie, S. S. W. 30102	Steane, Hartman & Co., Hartford	6.74	6.58
3395	Dixie, N. Y. C. 244610	Steane, Hartman & Co., Hartford	6.73	6.58
3396	Dixie, L. & N. 101208	Steane, Hartman & Co., Hartford	6.72	6.58
3398	Dixie, C. J. & W. 24114	Steane, Hartman & Co., Hartford	7.02	6.58
3390	J. G. & N. 7312	Steane, Hartman & Co., Hartford	6.92	....
3397	N. P. 24170	Steane, Hartman & Co., Hartford	6.78	....
4070	Bull, 92503	L. Wetstone & Sons, Inc., Hartford	6.70	6.88
4071	Bull, 17463	L. Wetstone & Sons, Inc., Hartford	6.69	6.88
4072	Dixie, 165708	L. Wetstone & Sons, Inc., Hartford	6.46	6.58
4073	Bull, 27986	L. Wetstone & Sons, Inc., Hartford	6.58	6.88
4074	Dixie	L. Wetstone & Sons, Inc., Hartford	6.32	6.58
	International Agricultural Corp., Boston, Mass.			
4649	....	Station agent, from stock of James T. Caffrey, Cromwell	6.90	6.58
	L. B. Lovitt & Co., Memphis, Tenn.			
3453	"Lovit"	E. H. Rollins, Granby	6.57	6.88
3585	"Lovit"	Fred H. Kendall, Granby	6.90	6.88
4046	"Lovit"	Henry E. Wells, Warehouse Point	7.00	6.88
4174	"Lovit"	Station agent, from stock of Louis C. Bunce, South Manchester ...	6.30	6.88
4182	"Lovit" (Off Grade)	Station agent, from stock of M. E. Thompson, Ellington	6.53	6.88
4183	"Lovit" (Off Grade)	Station agent, from stock of M. E. Thompson, Ellington...........	6.81	6.88
4232	"Lovit"	J. C. Dufford, Glastonbury	5.50	6.58
4561	"Lovit"	Edward Handel, Glastonbury	6.76	....
4457	"Lovit"	Station agent, from stock of Adolph Lanz, Ellington	6.48	6.88
4458	"Lovit"	Station agent, from stock of Mr. Rashall, Ellington	6.58	6.88
4701	"Lovit"	Albert P. Handel, Glastonbury ..	6.01	6.58

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Concluded.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
		Cottonseed Meal.		
	Memphis Cotton Seed Products, Memphis, Tenn.			
4657	Durham 36%	Station agent, from stock of Fred C. Morse, Guilford	6.08	5
	R. N. Neal & Co., Memphis, Tenn.			
3622	Triangle, No. 1 Del., L. & W. 12385	Clark Bros., Windsor	6.84	''
3623	Triangle, No. 2 Chicago & N. W. 104494	Clark Bros., Windsor	6.53	''
	Manufacturers Unknown.			
4228		The P. Schwartz Company, New London	5.29	
4756	1067	H. D. Haskins, Amherst, Mass.	5.33	
4757	1068	H. D. Haskins, Amherst, Mass.	6.50	
		Linseed Meal.		
	American Linseed Co., Chicago, Ill.			
3956	79282	Hatheway & Steane, Inc., Hartford	5.60	
3840	20104	Hatheway & Steane, Inc., Hartford	5.60	
3674	79282	Hatheway & Steane, Inc., Hartford	5.52	
3496	19020	Hatheway & Steane, Inc., Hartford	5.73	
3495	18304	Hatheway & Steane, Inc., Hartford	5.49	
3494	18428	Hatheway & Steane, Inc., Hartford	5.62	
3661	36003	A. N. Shepard & Son, Hartford	5.75	

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

PRECIPITATED BONE PHOSPHATE.

The phosphorus in this raw material is nearly all in the so-called "available" form. Precipitated bone phosphate is obtained as a by-product in the manufacture of gelatin.

Of the eight samples examined all exceeded their guaranties, so far as guaranties were given, with the exception of No. **3757.** In four cases no guaranties were quoted to us, but the samples were of good quality.

So far as prices were quoted available phosphoric acid from this source has cost about 6.4 cents per pound.

Analyses are given in Table V.

TABLE V. ANALYSES OF PRECIPITATED BONE PHOSPHATE.

	Manufacturer or Wholesale Dealer.	Place of Sampling.	Phosphoric Acid.			
			Citrate-insoluble.	Total.	"Available." Found.	"Available." Guaranteed.
	Sampled by Station:		%	%	%	%
1	Apothecaries Hall Co., Waterbury	At factory	2.08	38.40	36.32	36.0
4	L. T. Frisbie Co., New Haven	At factory	1.38	36.75	35.37	35.0
7	Olds & Whipple, Inc., Hartford	At factory	1.19	38.25	37.06	38.0
	Sampled by Purchaser:					
2	81821	American Sumatra Tobacco Co., Bloomfield	1.03	39.46	38.43	....
3	62943	American Sumatra Tobacco Co., Bloomfield	1.17	39.06	37.89	....
9	Apothecaries Hall Co., Waterbury 49514	Hatheway & Steane, Inc., Hartford	2.49	40.14	37.65	36.0
9	Olds & Whipple, Inc., Hartford	John M. Herr, Burnside	0.60	39.85	39.25	38.0
6	10274	A. N. Shepard & Son, Hartford	1.89	41.28	39.39	....

ACID PHOSPHATE.

Acid phosphate is the chief source of phosphoric acid in mixed fertilizers. It is obtained by treating ground phosphate rock with sulphuric acid which results in the formation of calcium phosphate of the soluble mono-calcium type and calcium sulphate or gypsum. This mixture is allowed to remain in a tank or "hot bin" where it solidifies after which it is broken up and ground to a suitable condition for use in fertilizer mixtures. This raw material is generally guaranteed to contain 16 per cent of available phosphoric acid.

Twenty-one samples were analyzed all except four of which equalled or exceeded their guaranties. In one case a second sample showed no deficiency.

The average content of available phosphoric acid is 16.4 per cent. On the basis of the average of prices quoted, viz., $22.50, the cost of available phosphoric acid from this source has been about 6.9 cents per pound.

Analyses are given in Table VI.

TABLE VI. ANALYSES OF ACID PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. "Available." Found.	Phosphoric Acid. "Available." Guaranteed.	Station No.
	Sampled by Station.		%	%	%	%	
3751	American Agricultural Chemical Co., New York	Bristol Grain & Supply Co., Bristol	0.35	16.85	16.50	16.00	3751
4165	Apothecaries Hall Co., Waterbury	Sampled at factory, East Windsor	2.14	17.85	15.71	16.00	4165
3883	Armour's Fertilizer Works, New York	F. A. Bartlett Co., Stamford	0.45	16.10	15.65	16.00	3883
4127	Armour's Fertilizer Works, New York	F. A. Bartlett Co., Stamford	0.59	15.96	15.37	16.00	4127
4410	Berkshire Fertilizer Co., Bridgeport	C. Ahearn, Stratford	0.73	17.65	16.92	16.00	4410
4236	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	0.58	17.45	16.87	16.00	4236
3813	E. B. Clark Seed Co., Milford	G. R. Russell, Branford	0.58	17.35	16.77	16.00	3813
3742	Consolidated Rendering Co., Boston	L. T. Frisbie Co., New Haven	1.18	17.55	16.37	16.00	3742
4404	Eastern States Farmers' Exchange, Springfield, Mass.	Ridgewood Farm, North Haven	0.68	17.35	16.67	16.00	4404
4599	A. W. Higgins, South Deerfield, Mass.	J. D. Kelsey, Madison	1.83	19.10	17.27	16.00	4599
4467	International Agricultural Corp., Boston, Mass.	Wm. Colson, West Suffield	0.40	16.85	16.45	16.00	4467
4284	King Chemical Co., Bound Brook, N. J.	Meriden Farmers' Exchange, Meriden	0.23	16.75	16.52	16.00	4284
3756	Olds & Whipple, Inc., Hartford	Sampled at factory	1.15	18.15	17.00	16.00	3756
3920	Piedmont-Mt. Airy Guano Co., Baltimore, Md.	Seymour Grain & Coal Co., Seymour	1.25	17.30	16.05	16.00	3920
3790	The Rogers & Hubbard Co., Portland	H. D. Peters, Highwood	0.35	16.93	16.58	16.00	3790

TABLE VI. ANALYSES OF ACID PHOSPHATE—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. "Available." Found.	Phosphoric Acid. "Available." Guaranteed.	Station No.
	Sampled by Station.		%	%	%	%	
3794	I. P. Thomas & Son, Philadelphia, Pa.	L. B. Wooding, North Haven	2.40	17.45	15.05	16.00	3794
4024	I. P. Thomas & Son, Philadelphia, Pa.	D. L. Clark & Sons, Milford	1.80	17.90	16.10	16.00	4024
3811	F. S. Royster Guano Co., Baltimore, Md.	Hitchcock Hardware Co., Watertown	0.65	16.68	16.03	16.00	3811
4001	United States Guano Co., Baltimore, Md.	E. O. Chapman, North Haven	0.15	16.50	16.35	16.00	4001
4294	The Wilcox Fertilizer Co., Mystic	Henry Joy, Woodstock	0.33	17.90	17.57	17.00	4294
	Sampled by Purchaser.						
3925	The Wilcox Fertilizer Co., Mystic	Daigle Bros., Marion	0.24	16.88	16.64	16.00	3925

III. RAW MATERIALS CHIEFLY VALUABLE FOR POTASH.

The potash ingredient of mixed fertilizers is supplied chiefly in the forms of muriate (chloride) and of sulphate, but the carbonate and nitrate are also used. Tobacco growers in the New England States prefer their potash supply in the form of carbonate or sulphate.

Potash salts are furnished chiefly from German and French sources, but high grade muriate is now produced in California and Utah.

CARBONATE OF POTASH.

When pure, carbonate of potash contains 68.2 per cent of actual potash (K_2O), but commercial grades usually contain from 60 to 65 per cent.

The eleven samples examined this year all contained over 61 per cent, the range being from 61.1 to 66.6 per cent and the average 64.3 per cent.

Price quotations were limited, but at $125.00 per ton, which was the price quoted in two cases, potash from this source has cost about 9.7 cents per pound.

Analyses are given in Table VII.

MURIATE OF POTASH.

This raw material as obtained in commercial grades contains about 80 per cent potassium chloride which is equivalent to about 50.5 per cent of actual potash (K_2O). Guaranties for this salt are generally placed at 48 to 50 per cent potash.

Twelve samples were examined, all except one being official samples taken by the station agent. All samples exceeded 48 per cent of potash so that none can be regarded as inferior. However, four did not meet the guaranties under which they were sold. In one of these cases **4603**, another sample, **3924**, of the same goods submitted by a purchaser, considerably exceeded the guaranty.

Only two price quotations were obtained and these differed by $16.00 per ton. The average potash content of the salts examined is 50.4 per cent which, on the basis of the average of quoted prices, makes the cost of potash about 5.1 cents per pound.

Analyses are given in Table VII.

SULPHATE OF POTASH.

Commercial grades of this salt contain about 90 per cent of potassium sulphate equivalent to about 48 per cent of potash (K_2O), which is the usual guaranty.

Ten samples were examined and all exceeded 48 per cent and met higher guaranties where such were made. The average potash content is 49.29 per cent and the cost per pound has been about 6.6 cents.

Analyses are given in Table VII.

SULPHATE OF POTASH-MAGNESIA.

Two samples of this material were found to be of normal potash content and both met their guaranties.

Analyses are given in Table VII.

COTTON HULL ASHES.

Cotton hull ashes have not been used as fertilizer in this State to any considerable extent in recent years. They are obtained from the South where the hulls are used for fuel purposes.

They are variable in composition, containing from 10 to 40 per cent or more of potash, 2 to 12 per cent of phosphoric acid and about 10 per cent each of lime and magnesia. These ashes are free, or nearly so, from chlorides and were formerly used to a considerable extent in the Connecticut valley for growing tobacco.

Three samples were analyzed this year. Two of them, **4069** and **4173**, were of curious and unexplained composition. The potash content in these two samples, both of which represented the same stock, was between 8.50 and 9.00 per cent; they contained about 30 per cent of phosphoric acid and 4 and 11 per cent of lime and magnesia respectively.

Examination of the stock showed the material to consist largely of coarse fused masses or clinkers which were very high in phosphoric acid. The hulls had evidently been burned in such a way as to become largely mixed with phosphate.

Sample **4886** from a later shipment was of normal appearance and potash content.

Analyses are given in Table VII.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Carbonate of Potash.				
	Sampled by Station:		%	%	
4167	Apothecaries Hall Co., Waterbury	Sampled at factory	63.16	61.00	4167
	Sampled by Purchaser:				
4759	Apothecaries Hall Co., Waterbury	American Sumatra Tobacco Co., Bloomfield	63.95	61.00	4759
3671	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	65.46	61.00	3671
3961	Apothecaries Hall Co., Waterbury 78752	Hatheway & Steane, Inc., Hartford	64.35	61.00	3961
3554	A. Klipstein, New York City 83706	American Sumatra Tobacco Co., Bloomfield	64.24	....	3554
3555	A. Klipstein, New York City 84865	American Sumatra Tobacco Co., Bloomfield	64.98	....	3555
3556	A. Klipstein, New York City 67114	American Sumatra Tobacco Co., Bloomfield	64.35	....	3556
3557	A. Klipstein, New York City 8074	American Sumatra Tobacco Co., Bloomfield	64.11	....	3557
3558	A. Klipstein, New York City 92436	American Sumatra Tobacco Co., Bloomfield	64.83	....	3558
3559	A. Klipstein, New York City 94628	American Sumatra Tobacco Co., Bloomfield	66.59	....	3559
2689	J. E. Phelps, Suffield	P. J. Anderson, Tobacco Station, Windsor	61.12	....	2689
	Muriate of Potash.				
	Sampled by Station:				
3809	American Agricultural Chemical Co., New York City	Sampled at factory, New Haven	50.53	50.00	3809
3761	Apothecaries Hall Co., Waterbury	Sampled at factory	50.65	50.00	3761
3787	Armour Fertilizer Works, New York City	Harrison & Gould, Milford	48.83	48.00	3787

TABLE VII. ANALYSES OF POTASH SALTS, ETC.—*Continued.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Muriate of Potash. *Sampled by Station:*		%	%	
4158	Berkshire Fertilizer Co., Bridgeport	Sampled at factory	51.68	50.00	4158
4297	Berkshire Fertilizer Co., Bridgeport	E. N. Austin, Suffield	53.48	50.00	4297
4215	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	50.80	50.00	4215
3746	Consolidated Rendering Co., Boston, Mass.	Cheshire Reformatory, Cheshire	48.81	50.00	3746
4401	Eastern States Farmers' Exchange, Springfield, Mass.	Edward Myers, Bethany	48.88	50.00	4401
3851	The Rogers & Hubbard Co., Portland	H. D. Peters, Highwood	49.76	50.00	3851
4573	United States Guano Co., Baltimore, Md.	E. O. Chapman, North Haven	50.86	50.00	4573
4603	The Wilcox Fertilizer Co., Mystic	Sampled at factory	49.08	50.50	4603
	Sampled by Purchaser:				
3924	The Wilcox Fertilizer Co., Mystic	Daigle Bros., Marion	51.40	50.50	3924
	Sulphate of Potash. *Sampled by Station:*				
3766	American Agricultural Chemical Co., New York City	Geo. S. Phelps & Co., Thompsonville	49.78	48.00	3766
4430	Apothecaries Hall Co., Waterbury	Sampled at factory	48.60	48.00	4430
4296	Berkshire Fertilizer Co., Bridgeport	E. N. Austin, Suffield	49.04	48.00	4296
4217	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	48.80	48.00	4217
3743	Consolidated Rendering Co., Boston, Mass.	L. T. Frisbie Co., New Haven	49.68	48.00	3743

TABLE VII. ANALYSES OF POTASH SALTS, ETC.—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sulphate of Potash.				
	Sampled by Station:				
4499	The Mapes Formula & Peruvian Guano Co., New York City	S. J. Orr, West Suffield	50.26	48.00	4499
3754	Olds & Whipple, Inc., Hartford	Sampled at factory	49.65	48.65	3754
	Sampled by Purchaser:				
3667	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	48.51	48.00	3667
4760	Apothecaries Hall Co., Waterbury	American Sumatra Tobacco Co., Bloomfield	49.84	48.00	4760
4780	Olds & Whipple, Inc., Hartford	John M. Herr, Burnside	48.66	48.65	4780
	Sulphate of Potash-Magnesia.				
	Sampled by Station:				
4432	Apothecaries Hall Co., Waterbury	Sampled at factory	27.98	26.00	4432
3755	Olds & Whipple, Inc., Hartford	Sampled at factory	28.05	26.00	3755
	Cotton Hull Ashes.				
	Sampled by Station:				
4886	Ed. Eggert, Hartford	John Sullivan & Son, Suffield	15.04	....	4886
	Sampled by Purchaser:				
4173	Ed. Eggert, Hartford	John Sullivan & Son, Suffield	8.92	12.75	4069
4069	Ed. Eggert, Hartford	John Sullivan & Son, Suffield	8.62	12.75	4173

IV. RAW MATERIALS CONTAINING NITROGEN AND POTASH.

Six samples of this group of materials have been examined, three taken by the station agent and three sent by purchasers. Analyses are given in Table VIII.

3762. Nitrate of Soda and Potash. Apothecaries Hall Co., *Waterbury. Sampled by station agent at factory.*

4180. Nitrate of Soda and Potash. Apothecaries Hall Co., Waterbury. Sampled by station agent, stock of Chas. Cass, Wallingford.

4181. Nitrate of Soda and Potash. Apothecaries Hall Co., Waterbury. Sampled by station agent at factory, East Windsor.

4610. Nitrate of Soda and Potash. Apothecaries Hall Co., Waterbury. Submitted by Apothecaries Hall Co.

4489. Nitrate of Soda and Potash. Apothecaries Hall Co., Waterbury. Submitted by Jas. S. Burroughs Co., New York.

2688. Nitrate of Potash. Manufacturer unknown, stock of J. E. Phelps, Suffield.

Table VIII. Analyses of Nitrate of Soda and Potash, etc.

Station No.	3762	4180	4181	4610	4489	2688
Nitrogen:	%	%	%	%	%	%
found	14.78	15.24	14.88	....	14.80	13.72
guaranteed	14.80	14.81	14.81	....	14.80	....
Equivalent to ammonia:						
found	17.97	18.53	18.09	....	17.99	16.68
guaranteed	18.00	18.00	18.00	....	18.00	....
Potash:						
found	10.08	10.99	11.21	11.56	12.06	46.28
guaranteed	12.00	12.00	12.00	12.00	12.00	....

The five samples of nitrate of potash and soda represent the same original stock. This stock was offered by Apothecaries Hall Co., Waterbury, and purchased by them through Jas. S. Burroughs Co., New York. It was sold on a guaranty of 12 per cent potash and 18 per cent ammonia.

The first sample taken by the station agent, **3762**, was considerably deficient in potash. Further official samples taken at the warehouse of Apothecaries Hall Co. and from the stock of a purchaser failed to substantiate the 12 per cent guaranty of potash but were found to be considerably higher in potash than our first sample. Exchanges of samples were made between the importers, the dealer and the Station for purposes of checking results. Numbers **4181**, **4610** and **4489** are portions of one official sample. Number **4489** represents the portion submitted first to Jas. S. Burroughs Co., New York, who afterwards sent us a subsample for a check analysis. Unfortunately, the package was damaged

in transit to us and our result is without significance so far as checking the analysis made for the importers is concerned. Their result for potash was reported to us at 12.88 per cent.

The stock in question was rather coarse and somewhat lumpy, hence sampling was more difficult than usual. Our first result is apparently too low to fairly represent these goods; but there is no evidence that the product as received here would average as much as 12 per cent of potash.

V. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

DRY GROUND FISH.

Non-edible fish such as menhaden and dogfish and the offal from fish canneries are used in making this fertilizer material. The fish is steamed and pressed to remove oil and afterwards dried and ground.

Eighteen samples, ten of which were sampled by the station agent, were analyzed.

All samples equalled or exceeded guaranties for phosphoric acid and all, with one exception, **4635**, substantially met or exceeded the guaranties for nitrogen. This material has contained, on an average, 8.55 per cent of nitrogen and 6.92 per cent of phosphoric acid. At the price quoted, about $70.00 per ton, and allowing 4 cents per pound for phosphoric acid, nitrogen from this source has cost about 37.7 cents per pound.

Analyses are given in Table IX.

TABLE IX. ANALYSES OF DRY GROUND FISH.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Total found.	Phosphoric Acid. Total guaranteed.	Station No.
	Sampled by Station:		%	%	%	%	%	
3878	American Agricultural Chemical Co., New York City	Sampled at factory, New Haven	8.18	8.23	9.95	8.13	6.00	3878
3764	Apothecaries Hall Co., Waterbury	Sampled at factory	8.38	8.20	10.19	7.13	5.00	3764
4671	Apothecaries Hall Co., Waterbury	J. P. Norton, Broad Brook	8.28	8.20	10.07	5.85	5.00	4671
3789	Berkshire Fertilizer Co., Bridgeport	Sampled at factory	8.39	8.22	10.20	6.35	6.00	3789
4295	Berkshire Fertilizer Co., Bridgeport	E. N. Austin, Suffield	8.66	8.22	10.53	6.28	6.00	4295
4301	Berkshire Fertilizer Co., Bridgeport	T. W. Ryan, Stratford	8.37	8.22	10.18	6.33	6.00	4301
4213	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	8.42	8.00	10.24	6.90	6.00	4213
4238	Consolidated Rendering Co., Boston, Mass.	L. T. Frisbie Co., New Haven	8.54	8.22	10.38	6.90	6.40	4238
3902	Olds & Whipple, Inc., Hartford	Sampled at factory	9.10	8.23	11.06	7.05	5.00	3902
4635	The Wilcox Fertilizer Co., Mystic	Sampled at factory	8.56	9.04	10.41	7.10	6.00	4635
	Sampled by Purchaser:							
4763	Apothecaries Hall Co.; Waterbury	American Sumatra Tobacco Co., Bloomfield	8.34	8.20	10.14	5.70	5.00	4763
3503	Apothecaries Hall Co., Waterbury 49514	Hatheway & Steane, Inc., Hartford	8.94	8.20	10.87	7.72	5.00	3503

TABLE IX. ANALYSES OF DRY GROUND FISH.—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Total found.	Phosphoric Acid. Total guaranteed.	Station No.
	Sampled by Purchaser:		%	%	%	%	%	
3549	Apothecaries Hall Co., Waterbury (Truck)	Hatheway & Steane, Inc., Hartford	8.72	8.20	10.60	7.73	5.00	3549
3844	Apothecaries Hall Co., Waterbury 79527	Hatheway & Steane, Inc., Hartford	8.95	8.20	10.88	7.25	5.00	3844
4257	Berkshire Fertilizer Co., Bridgeport	Paul and Ed. Rostek, Melrose	8.65	8.22	10.52	6.60	6.00	4257
3414	Olds & Whipple, Inc., Hartford	American Sumatra Tobacco Co., Bloomfield	9.00	8.23	10.94	7.12	5.00	3414
4778	Olds & Whipple, Inc., Hartford	John M. Herr, Burnside	8.15	8.23	9.91	7.08	5.00	4778
3664	10274	A. N. Shepard & Son, Hartford	8.26	....	10.04	7.30	....	3664

TANKAGE.

The material sold under this name is generally bone and meat refuse material which has been cooked with steam, defatted and dried. The analysis depends upon the relative amounts of bone and meat in the product; tankage containing less than 5 per cent of nitrogen and over 15 per cent of phosphoric acid has a considerable admixture of bone. High grade tankage contains 8 to 10 per cent of nitrogen and from 5 to 10 per cent of phosphoric acid.

Garbage tankage is obtained by processing city garbage and is of less value as a fertilizer. Such material will usually contain 2.5 to 3.5 per cent of nitrogen and from 2 to 5 per cent of phosphoric acid.

Sixteen samples were analyzed, all of the bone and meat variety. Samples **4237**, **3783** and **4120** did not meet guaranties for nitrogen, while one sample, **3745**, was deficient in phosphoric acid.

Analyses are given in Table X.

GROUND BONE.

Thirty samples of ground bone or bone meal, twenty-one of which were sampled by the station agent, were analyzed.

All of the guaranties for phosphoric acid were met but samples **4477**, **4484**, **3793** and **4574** did not meet their guaranties for nitrogen.

Analyses are given in Table XI.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen: Total found.	Nitrogen: Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid: Found.	Phosphoric Acid: Guaranteed.	Mechanical Analysis: Finer than 1-50 inch.	Mechanical Analysis: Coarser than 1-50 inch.	Station No.
	Sampled by Station:		%	%	%	%	%	%	%	
3749	Apothecaries Hall Co., Waterbury	J. A. Glasnap, West Cheshire	3.88	3.29	4.72	23.90	20.00	55.0	45.0	3749
3763	Apothecaries Hall Co., Waterbury	Sampled at factory	8.22	7.40	9.99	4.75	3.00	61.0	39.0	3763
4419	Berkshire Fertilizer Co., Bridgeport	T. W. Ryan, Stratford	7.38	7.40	8.97	11.10	6.86	43.0	57.0	4419
4237	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	7.26	7.40	8.83	10.95	9.00	40.0	60.0	4237
3745	Conn. Fat Rendering and Fertilizer Corp., New Haven	Sampled at factory	4.26	3.29	5.18	19.80	22.88	54.0	46.0	3745
3783	Consolidated Rendering Co., Boston	Rand & Christensen, Wilson	7.15	7.41	8.69	14.60	9.15	32.0	68.0	3783
3795	Consolidated Rendering Co., Boston	Knowles & Lombard, Guilford	10.77	....	13.09	7.35	....	21.0	79.0	3795
4061	Consolidated Rendering Co., Boston	Lyman Farms, Middlefield	3.90	....	4.74	17.68	....	37.0	63.0	4061
4487	Consolidated Rendering Co., Boston	L. T. Frisbie Co., New Haven	5.22	4.94	6.35	15.53	14.00	27.0	73.0	4487
4681	Consolidated Rendering Co., Boston	L. T. Frisbie Co., New Haven	7.50	7.41	9.12	10.25	9.15	27.0	73.0	4681
4655	International Agricultural Corp., Boston	Frank Flannigan, West Cheshire	4.89	4.93	5.95	15.65	11.00	52.5	47.5	4655
4120	The Rogers & Hubbard Co., Portland	H. D. Peters, Highwood	4.45	4.93	5.41	15.68	....	42.0	58.0	4120
4578	I. P. Thomas & Son, Philadelphia, Pa.	Frank Seaman, Milford	5.69	5.76	6.92	11.14	11.25	37.0	63.0	4578
4602	Wilcox Fertilizer Co., Mystic	Sampled at factory	7.89	7.40	9.59	8.33	4.57	51.5	48.5	4602
	Sampled by Purchaser:									
3780	Consolidated Rendering Co., Boston	C. R. Burr & Co., Inc., Manchester	6.37	....	7.74	12.75	....	11.0	89.0	3780
3923	Wilcox Fertilizer Co., Mystic	Daigle Bros., Marion	9.81	7.40	11.93	4.30	4.57	65.0	35.0	3923

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Found.	Nitrogen. Guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
	Sampled by Station:		%	%	%	%	%	%	%	
3750	American Agricultural Chemical Co., New York	Bristol Grain & Supply Co., Bristol	2.64	2.47	3.21	23.60	22.88	61.5	38.5	3750
3765	Apothecaries Hall Co., Waterbury	Sampled at factory	3.96	3.29	4.81	22.70	20.00	50.0	50.0	3765
3875	Armour's Fertilizer Works, New York	Harrison & Gould, Milford	2.52	2.47	3.06	23.70	23.00	37.0	63.0	3875
3791	Berkshire Fertilizer Co., Bridgeport	W. D. Thomas, Highwood	2.76	2.47	3.36	22.75	20.00	51.0	49.0	3791
4218	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	2.65	2.47	3.22	23.75	22.00	65.0	35.0	4218
3881	Consolidated Rendering Co., Boston	Herbert Grulich, Meriden	2.74	2.46	3.33	25.95	22.90	49.0	51.0	3881
4477	Consolidated Rendering Co., Boston	Rockville Milling Co., Rockville	1.87	2.05	2.27	28.20	25.18	56.5	43.5	4477
4484	Eastern States Farmers' Exchange, Springfield, Mass.	H. H. McKnight, Ellington	2.22	2.46	2.70	24.55	23.09	44.0	56.0	4484
3905	L. T. Frisbie Co., New Haven	Geo. S. Jennings, Southport	2.96	2.46	3.60	26.30	22.90	48.5	51.5	3905
4482	L. T. Frisbie Co., New Haven	Frank S. Platt Co., New Haven	4.05	3.28	4.92	22.32	22.00	42.0	58.0	4482
4286	International Agricultural Corp., Boston	James T. Caffrey, Cromwell	2.90	2.47	3.53	23.25	22.00	64.0	36.0	4286
4503	New England By-Products Co., Lawrence, Mass.	M. Kosenko, Plainville	3.90	3.75	4.74	26.30	25.00	77.0	23.0	4503
3760	Olds & Whipple, Inc., Hartford	Sampled at factory	3.20	2.50	3.89	25.45	22.00	47.0	53.0	3760
4696	Piedmont-Mt. Airy Guano Co., Baltimore	Seymour Grain & Coal Co., Seymour	2.44	2.47	2.97	25.35	22.90	62.5	37.5	4696
3782	The Rogers & Hubbard Co., Portland	Cadwell & Jones, Hartford	3.85	3.82	4.68	25.95	24.70	81.0	19.0	3782
3785	The Rogers & Hubbard Co., Portland	Sampled at factory	3.41	3.29	4.14	23.60	20.50	40.0	60.0	3785

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Found.	Nitrogen. Guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
	Sampled by Station:		%	%	%	%	%	%	%	
4002	F. S. Royster Guano Co., Baltimore	Hitchcock Hardware Co., Watertown	2.90	2.47	3.53	23.08	22.90	65.0	35.0	4002
3914	M. L. Shoemaker & Co., Philadelphia	Olds & Whipple, Inc., Hartford	5.67	4.51	6.89	20.50	20.00	37.5	62.5	3914
3793	I. P. Thomas & Son, Philadelphia	L. B. Wooding, North Haven	2.28	2.45	2.77	25.65	23.00	51.0	49.0	3793
4574	United States Guano Co., Baltimore	Rackliffe Bros. Co., New Britain	2.24	2.46	2.72	23.75	22.00	38.5	61.5	4574
4292	The Wilcox Fertilizer Co., Mystic	Henry Joy, Woodstock	2.84	2.46	3.45	23.73	22.00	49.0	51.0	4292
	Sampled by Purchaser:									
3502	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	4.52	3.29	5.50	21.94	20.00	64.0	36.0	3502
3845	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	4.13	3.29	5.02	22.45	20.00	49.5	50.5	3845
3846	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	4.00	3.29	4.86	23.35	20.00	72.5	27.5	3846
3959	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	3.88	3.29	4.72	20.80	20.00	45.0	55.0	3959
3513	29790	American Sumatra Tobacco Co., Bloomfield	3.28	....	3.99	24.40	....	48.0	52.0	3513
3514	700444	American Sumatra Tobacco Co., Bloomfield	3.18	....	3.87	25.09	....	43.0	57.0	3514
3515	40855	American Sumatra Tobacco Co., Bloomfield	2.98	....	3.62	23.76	....	46.0	54.0	3515
3516	13323	American Sumatra Tobacco Co., Bloomfield	2.76	....	3.36	23.22	....	39.0	61.0	3516
4521	93489	American Sumatra Tobacco Co., Bloomfield	3.14	....	3.82	25.10	....	50.0	50.0	4521

VI. MIXED FERTILIZERS.

MIXTURES CONTAINING ONLY NITROGEN AND *PHOSPHORIC ACID.*

Three samples of this group of materials were analyzed.

3758. Ammo Phos. American Cyanamid Co., New York. Sampled by the station agent from stock of Olds & Whipple, Inc., Hartford, Conn.

4536. Shoemaker's "Swift-Sure" Tobacco Starter. M. L. Shoemaker & Co., Philadelphia, Penn. Sampled by the station agent from stock of F. S. Bidwell Co., Windsor Locks.

4501. O & W High Grade Tobacco Starter. Olds & Whipple, Inc., Hartford, Conn. Sampled by the station agent from stock of E. O. Gates, Pine Meadow.

	3758 %	4536 %	4501 %
Nitrogen, found	16.37	3.52	9.56
guaranteed	16.45	3.28	8.23
Ammonia equivalent to nitrogen	19.90	4.28	11.62
Phosphoric acid, total	22.30	11.45	4.68
available, found	21.72	9.95	4.53
guaranteed	20.00	10.00	3.00

Ammo Phos contains no organic nitrogen. The quality of the organic nitrogen in the two other samples was satisfactory as judged by the usual laboratory methods.

MIXTURES CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

Analyses of two hundred and forty-seven official samples of complete fertilizers, and of six samples submitted by purchasers or others interested, are given in Table XII.

In this table the "grade" of the fertilizer is given in addition to the brand name; and in the analysis the items of ammonia, available phosphoric acid and potash found are given in bold face type so that the comparison between the composition claimed and that found may be more readily seen. A brand represented as 4-8-4, for example, is guaranteed to contain not less than 4 per cent of ammonia, not less than 8 per cent of available phosphoric acid and not less than 4 per cent of potash.

Some of the conspicuous facts shown by the inspection this year may be seen in the following summary:

Total number of official samples analyzed		247
Samples considerably deficient in		
one item	69	
two items	13	
three items	1	
total		83
Total deficiencies		98
Total of guaranties made (247 x 3)		741
Samples showing deficiencies in money value greater than $1.00 per ton		11

This tabulated statement shows that about 1/3 of the samples examined have failed to fully satisfy their guaranties in all of the three items of plant food guaranteed; that of the total number of guaranties made (there being three for each sample), about 87 per cent have been substantially met or exceeded; that considerable losses in money value (greater than $1.00 per ton), have not been involved, excepting eleven samples representing only about 4.5 per cent of the total number.

These data are in close accord with similar calculations made last year. One sample in three has failed to meet the claim in one or more of the three items of plant food guaranteed. While many of these shortages are relatively small, and perhaps within the limit of reasonable analytical differences, nevertheless *guaranties required by law are minimum guaranties and they ought to be met in all cases.*

CONCERNING DEFICIENT SAMPLES.

In ten samples this year deficiencies in plant food have exceeded $1.00 per ton.[1] In some cases second samples have not been found deficient or such deficiencies have not exceeded the above value. In other cases, however, second samples could not be secured.

TABLE XIII. SAMPLES SHOWING COMMERCIAL DEFICIENCIES.

No.	Brand.	Approximate deficiency in money value per ton.
4090	Stockbridge Early Crop Manure 5-8-7	$1.29
4223	Armour's Big Crop Fertilizer 5-8-7	2.24
3986	Armour's Big Crop Fertilizer 5-8-7	1.16
3884	Bartlett's Green Tree Food 6-8-4	3.17[2]
4483	Eastern States 8-16-20	5.84
4511	Piedmont-Mt. Airy Harvest Brand 6-8-6	2.45
4544	Rogers & Hubbard 10-3-8	3.68[2]
4539	Royster's 5% Truck Guano 5-8-7	11.58[3]
4547	Royster's Valley Tobacco Formula 5-4-5	2.36
4579	U. S. Fertilizer Chemical Co. Volco Ideal 2.4-5-8.	3.41
3921	Woodruff's Home Mixed Fertilizer 4-8-6	1.18

[1] In calculating these values, averages have been balanced against shortages and ammonia has been reckoned at 21 cents per pound, available phosphoric acid at 6 cents and potash at 4½ cents.

[2] Second sample not deficient.

[3] See page 52.

3884. Bartlett's Green Tree Food. Both this sample and a second sample, **4126**, were low in "available" phosphoric acid. The manufacturer explained that a good share of the phosphorus used was derived from bone. Since the conventional method for determining "available" phosphoric acid does not apply satisfactorily to bone and tankage, the low results reported may be thus explained.

4539. Royster's 5% Truck Guano. This sample was taken from a small lot of six bags. The analysis shows only about one-half as much nitrogen as is guaranteed and the manufacturer raised the question of a possible mixture with other goods when our sample was drawn. We are unable to find any error in the identity of the brand or in the sampling; and our analytical results have heen checked by ourselves and substantially confirmed by the manufacturer. It is unfortunate, however, that other shipments of this brand could not be located and further analyses made.

4510. Piedmont-Mt. Airy Guano Co., Harvest Brand 4-6-10. This sample showed a deficiency of 2.5 per cent in potash.

4023. I. P. Thomas & Sons Economy Fertilizer. This sample was 1.49 per cent below guaranty in available phosphoric acid. If the phosphorus was derived from bone the explanation already given for No. **3884** applies here.

4058, **4293**. Wilcox Potato and Vegetable Phosphate, 4-8-6. Both samples were deficient in potash.

4178, 4453 and **4754**. Sanderson's Atlantic Coast Bone Fish and Potash. These three samples were all low in available phosphoric acid but all represented the same stock. Another sample, **4416**, from a different source was not deficient. Phosphoric acid in this mixture is derived from bone.

Commercial Deficiencies for a Period of Years.

In a system of inspection where many brands are represented by a single analysis the products of the several manufacturers may not be fairly evaluated in any one year. Although it is our practice to examine at least two samples of any brand showing considerable deficiencies, a second sample is not alway obtainable. Comparisons are more informing, therefore, if made upon data covering a period of years. A number of different bases might be chosen for such comparisons, but since it has been our practice for many years to cite brands in which commercial deficiencies amount to one dollar or more per ton, these data have been compiled for the 6-year period 1921-1926, and are tabulated in Table XIV. No manufacturer is included unless ten or more samples have been analyzed in the period covered. The compilation shows that of a total of about 1500 samples analyzed less than 10 per cent have fallen short of guaranties to any considerable extent

in commercial value. Or, in other words, purchasers have received commercial values represented by the guaranties in over 90 per cent of purchases made.

TABLE XIV. COMMERCIAL DEFICIENCIES 1921-1926 INCLUSIVE.

Manufacturer.	Total number of samples.	Number equaling or exceeding guaranties in money value.	Per cent for 6 yr. period.	Per cent for 1926.
American Agricultural Chemical Co.	259	247	95	98
Apothecaries Hall Co.	49	49	100	100
Armour Fertilizer Works	64	46	72	78
Atlantic Packing Co.	43	39	91	100
Berkshire Fertilizer Co.	51	51	100	100
Boardman, F. E.	12	12	100	100
Bowker Fertilizer Co. [1]	71	63	...	...
Bridges, A. D. & Sons	13	13	100	100
Chittenden, E. D. Co.	39	35	90	100
Clark, E. B. Seed Co.	28	26	93	100
Coe-Mortimer Co.	30	27	90	...
Eastern States Farmers' Exchange	56	47	84	86
Essex Fertilizer Co.	40	39	98	100
Frisbie, L. T. Co.	65	55	85	100
International Agricultural Corp.	53	48	91	100
Lowell Fertilizer Co.	61	53	87	100
Mapes Fertilizer and Peruvian Guano Co.	77	76	99	100
New England Fertilizer Co.	48	45	94	100
Nitrate Agencies Co.	14	11	79	...
Olds & Whipple, Inc.	37	37	100	100
Parmenter & Polsey Fertilizer Co.	21	20	95	100
Piedmont-Mt. Airy Guano Co.	24	15	63	80
Rogers & Hubbard Co., The	82	79	96	93
Royster, F. S. Guano Co.	45	33	73	75
Sanderson Fertilizer & Chemical Co.[1]	41	39	...	...
Shoemaker, M. L. & Co.	17	17	100	100
Springfield Rendering Co.	25	23	92	100
Thomas, I. P. & Son	12	12	...	100
Virginia-Carolina Chemical Co.	49	46	94	100
Wilcox Fertilizer Works	50	47	94	100
Worcester Rendering Co.	21	18	86	100
Total	1,497	1,368	91	96

[1] Included under American Agricultural Chemical Co. this year.

DECREASE IN PROPORTION OF FERTILIZER WITH LOW PLANT FOOD CONTENT.

In a previous report[1] it has been pointed out that nitrogen costs two to three times as much in low grade (1 per cent ammonia) fertilizers as in high grade mixtures.

[1] Conn. Exp. Sta., Bull. 241, p. 110, 1922.

A study of grades with reference to ammonia content, also cited in an earlier report,[1] shows that in the period 1921 to 1924 inclusive, the proportion of samples containing 1 per cent of ammonia decreased from 10 per cent to 2 per cent; that the proportion containing 3 per cent or less of ammonia decreased from 54 per cent to 30 per cent; and that the proportion containing 4 per cent or more of ammonia increased from 46 per cent to 70 per cent.

At the Massachusetts conference of the Soil Improvement Committee it was recently shown[2] that low analysis (less than 14 per cent of total plant food) mixtures have decreased both in number and tonnage. Thus, in 1922 there were 29 low analysis mixtures in Massachusetts representing a tonnage of about 8000; in 1925 there were only 9 such mixtures representing a tonnage of less than 2100. It was also shown that of the total registrations in New England in 1925, 784 were high analysis (14 per cent or over) brands and 126 were brands containing less than 14 per cent of plant food. On an average, low analysis brands comprised about 14 per cent of total registrations in New England, varying in the several States from 1/10 to 1/5 of their total registrations.

New England "Standard Nine."

Nine standard grades have been recommended for use in New England. The experience in this State has been that in the three years following the proposal of these nine grades, the number of samples analyzed which corresponded exactly to the "standard nine" comprised in 1923, 32 per cent; in 1924, 36 per cent; and in 1925, 44 per cent, of the total. During the year just passed the proportion is 44 per cent. The data show an increasing number of samples each year excepting the last, falling in the selected grades, but the proportion is still less than ½ of the total.

Citing Director Haskell's report again it appears, from a tonnage standpoint, that in the four-year period 1922-1925 inclusive, five, of the "standard nine," viz., 4-8-4, 5-8-7, 5-4-5, 8-6-6, and 3-10-4, have maintained, or increased in, tonnage; three grades, viz., 0-12-6, 2-12-4 and 3-10-6 serve no evident necessity judging from tonnage returns; and one grade, 4-8-6, has shown a marked decrease in tonnage. Some of the standard grades have, moreover, been outstripped in tonnage by closely related formulas, such as 4-8-7, 3-8-4, and 3-8-6. The report concludes that there is apparent need of revision of the nine grades originally proposed.

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[1] Conn. Exp. Sta., Bull. 261, p. 57, 1924.

[2] Report of S. B. Haskell, Director of the Massachusetts Experiment Station.

Our classification of samples this year with respect to the "Standard Nine" is as follows:

Grade.	No. of Samples.
0-12-6	0
2-12-4	4
3-10-4	7
3-10-6	3
4- 8-4	35
4- 8-6	4
5- 4-5	24
5- 8-7	31
8- 6-6	1
Total	109

Other grades in which a considerable number of samples have fallen are as follows:

Grade.	No. of Samples
2-8-2	8
3-8-4	17
4-8-7	17
7-6-5	8
Total	50

QUALITY OF THE INSOLUBLE ORGANIC NITROGEN.

The present accepted methods of evaluating the insoluble organic nitrogen in fertilizer materials distinguishes between the better and the poorer forms of nitrogen. Activity values below 50 per cent by the alkaline method and below 80 per cent by the neutral method are accepted as indicating inferior nitrogenous material. Both methods should be applied before judgment is passed in any case.

During the past season four samples have shown activity values somewhat less than those mentioned, but in all of them the water-soluble nitrogen practically equalled or exceeded the guaranties of total nitrogen and the samples were passed.

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampli
	Sampled by Station: **American Agricultural Chemical Co., New York.**		
877	Acme Fertilizer	1-9-4	North Haven ..
221	Aroostook Potato Manure	5-8-7	Bloomfield ....
938	Complete General Fertilizer	3-8-4	North Haven ..
665	Double A Tobacco Fertilizer	5-4-5	Gaylordsville ..
939	Farmers' Friend Fertilizer	2-12-4	North Haven ..
935	Gladiator Fertilizer	4-8-7	New Britain ..
093	Grass and Lawn Top Dressing	6-6-4	Stafford Springs
668	Hi-Grade Tobacco Manure	7-4-7	Windsor ......
934	Monarch Fertilizer	4-8-4	New Britain ..
664	Old Hickory Fertilizer	2-8-10	Granby ....
084	Bowker's All Round Fertilizer	3-8-4	New Milford ..
091	Bowker's Market Garden Fertilizer	4-8-4	Mansfield Depot
088	Bowker's Potato and Vegetable Phosphate	2-9-3	Willimantic ...
089	Bowker's Sure Crop Fertilizer	1-9-4	Willimantic ...
092	Bradley's Blood, Bone and Potash	5-8-7	Stafford Spring
094	Bradley's Complete Manure for Potatoes and Vegetables	4-8-7	Stafford Spring
414	Bradley's Complete Tobacco Manure	5-4-5	Glastonbury ...
943	Bradley's Eclipse Fertilizer	1-9-4	Meriden ......
412	Bradley's Northland Potato Grower	4-8-4	Simsbury .....
219	Bradley's Potato Fertilizer	2-9-3	Stafford Spring
937	Bradley's Potato Manure	3-8-4	Suffield ....
936	Bradley's XL Superphosphate of Lime	3-10-4	Thompsonville
941	National Aroostook Special Fertilizer	5-8-7	Silver Lane ...
415	National Complete Tobacco Fertilizer	5-4-5	Simsbury .....
942	National Market Garden Fertilizer	3-8-4	Silver Lane ...
411	National Pine Tree State Potato Fertilizer	4-8-4	Warehouse Poin
755	National Pine Tree State Potato Fertilizer	4-8-4	New Haven ...
944	National Premier Potato Manure	4-8-7	Greenwich ....
178	Sanderson's Atlantic Coast Bone, Fish and Potash	3-10-4	West Cheshire
416	Sanderson's Atlantic Coast Bone, Fish and Potash	3-10-4	Simsbury .....
453	Sanderson's Atlantic Coast Bone, Fish and Potash	3-10-4	West Cheshire
754	Sanderson's Atlantic Coast Bone, Fish and Potash	3-10-4	West Cheshire
413	Sanderson's Complete Tobacco Grower	5-4-5	New Milford ..
176	Sanderson's Corn Superphosphate	2-9-3	South Coventry
940	Sanderson's Formula A	4-8-4	Guilford ......
177	Sanderson's Formula B	4-8-7	West Cheshire .
179	Sanderson's Potato Manure	3-8-4	Durham ....

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
In nitrates.	In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
%	%	%	%	%	%	%	%	%	%	%	
0.07	0.39	0.41	0.19	1.06	1.29	0.35	9.43	9.08	4.36	4.36	3877
0.44	2.56	0.54	0.49	4.03	4.90	0.33	8.64	8.31	7.14	7.14	4221
0.15	1.45	0.49	0.46	2.55	3.10	0.50	8.73	8.23	4.05	4.05	3938
0.69	0.73	0.01	2.76	4.19	5.09	0.18	4.23	4.05	0.48	5.65	4665
0.10	0.90	0.36	0.40	1.76	2.14	0.50	12.50	12.00	4.04	4.04	3939
0.31	1.74	0.68	0.45	3.18	3.87	0.73	8.70	7.97	6.95	6.95	3935
1.63	2.50	0.40	0.55	5.08	6.18	0.38	6.60	6.22	3.84	3.84	4093
0.65	0.72	0.17	4.18	5.72	6.95	0.50	5.40	4.90	0.35	7.00	4668
0.46	1.73	0.37	0.62	3.18	3.87	0.38	8.19	7.81	4.02	4.02	3934
0.06	0.88	0.45	0.32	1.71	2.08	0.73	8.75	8.02	9.74	9.74	4664
0.10	1.36	0.55	0.54	2.55	3.10	0.83	8.98	8.15	4.05	4.05	4084
0.43	1.72	0.43	0.62	3.20	3.89	0.45	8.45	8.00	3.79	3.79	4091
0.02	0.78	0.50	0.38	1.68	2.04	0.66	9.68	9.02	3.38	3.38	4088
0.03	0.33	0.39	0.22	0.97	1.18	0.45	9.50	9.05	4.01	4.01	4089
0.35	2.50	0.64	0.53	4.02	4.89	0.40	8.57	8.17	7.11	7.11	4092
0.45	1.84	0.69	0.47	3.45	4.19	0.71	8.69	7.98	7.19	7.19	4094
0.52	0.58	0.15	2.65	3.90	4.74	0.31	4.00	3.69	0.41	5.80	4414
0.10	0.36	0.33	0.23	1.02	1.24	0.40	9.57	9.17	4.00	4.00	3943
0.38	1.78	0.64	0.49	3.29	4.00	0.95	8.95	8.00	3.90	3.90	4412
0.11	0.78	0.42	0.35	1.66	2.03	0.68	9.34	8.66	3.40	3.40	4219
0.06	1.45	0.59	0.42	2.52	3.06	0.55	8.55	8.00	4.03	4.03	3937
0.06	1.42	0.72	0.39	2.59	3.15	0.73	10.72	9.99	4.01	4.01	3936
0.37	2.60	0.52	0.46	3.95	4.80	0.51	8.47	7.96	6.86	6.86	3941
0.41	0.67	0.16	2.68	3.92	4.77	0.28	4.90	4.62	0.56	5.14	4415
0.13	1.40	0.47	0.45	2.45	2.98	0.48	8.51	8.03	3.96	3.96	3942
0.34	1.68	0.43	0.63	3.08	3.74	0.48	8.50	8.02	3.93	3.93	4411
0.36	1.82	1.22		3.40	4.13	0.98	9.00	8.02	3.78	3.78	4755
0.37	1.73	0.79	0.42	3.31	4.02	0.66	8.51	7.85	7.59	7.59	3944
0.46	1.74	0.50	0.57	3.27	3.98	0.66	8.60	7.94	4.04	4.04	4178
0.12	1.32	0.61	0.47	2.52	3.06	0.85	11.00	10.15	3.97	3.97	4416
0.36	1.62	0.55	0.49	3.02	3.67	0.73	9.50	8.77	3.95	3.95	4453
0.23	1.57	1.10		2.90	3.53	0.80	10.00	9.20	4.18	4.18	4754
0.42	0.56	0.25	2.83	4.06	4.94	0.23	4.28	4.05	0.47	5.30	4413
0.13	0.68	0.40	0.35	1.56	1.89	0.38	9.33	8.95	2.96	2.96	4176
0.45	1.79	0.44	0.61	3.29	4.00	0.42	8.42	8.00	3.97	3.97	3940
0.72	1.23	0.12	1.38	3.45	4.19	1.63	9.55	7.92	1.04	6.68	4177
0.12	1.46	0.39	0.53	2.50	3.04	0.53	8.53	8.00	3.98	3.98	4179

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **American Agricultural Chemical Co., New York**—*Concluded.*		
4175	Sanderson's Top Dressing for Grass and Grain	6-6-4	South Coventry
4090	Stockbridge Early Crop Manure	5-8-7	Mansfield Depot
3933	Stockbridge Hill and Drill Fertilizer	4-8-7	Bristol
4087	Stockbridge Tobacco Manure	5-4-5	Glastonbury
	Apothecaries Hall Co., Waterbury.		
3880	Liberty Corn and All Crops 2-8-2	2-8-2	Branford
3885	Liberty Corn, Fruit and All Crops 2-12-4	2-12-4	Greenwich
3992	Liberty Fish, Bone and Potash 3-8-3	3-8-3	Branford
3985	Liberty High Grade Market Gardeners 5-8-7	5-8-7	West Cheshire
4433	Liberty High Grade Tobacco Manure 7-4-7	7-4-7	East Windsor
3990	Liberty Potato and Market Gardeners' Special 4-8-4	4-8-4	North Haven
3991	Liberty Onion Special (Potash as Sulphate) 4-8-7	4-8-7	North Haven
4436	Liberty Potato and General Crop 4-8-10	4-8-10	Rockville
4169	Liberty Tobacco Special 5-4-5	5-4-5	East Windsor
3995	*Liberty Top Dresser for Grass and Grain* 10-3.5-8	10-3.5-8	Greenwich
	Armour Fertilizer Works, New York.		
4161	Armour's Big Crop Fertilizer 3-8-4	3-8-4	Thompsonville
4606	Armour's Big Crop Fertilizer 3-8-4	3-8-4	Waterbury
3987	Armour's Big Crop Fertilizer 4-8-4	4-8-4	Milford
4222	Armour's Big Crop Fertilizer 4-8-4	4-8-4	Madison
4429	Armour's Big Crop Fertilizer 4-6-10	4-6-10	Wallingford
3986	Armour's Big Crop Fertilizer 5-8-7	5-8-7	Milford
4223	Armour's Big Crop Fertilizer 5-8-7	5-8-7	Madison
4162	Armour's Big Crop Tobacco Special 5-4-5	5-4-5	Thompsonville
4428	Armour's Corn Grower 2-8-2	2-8-2	Danbury
	Atlantic Packing Co., New Haven, Conn.		
4407	Atlantic 4-8-7	4-8-7	Glastonbury
4439	Atlantic 5-4-16	5-4-16	Glastonbury
4438	Atlantic Grain Fertilizer 2-8-2	2-8-2	South Windsor
4164	Atlantic Special Vegetable 4-8-4	4-8-4	Silver Lane
4408	Atlantic Tobacco Grower 5-4-5	5-4-5	East Hartford
4669	Atlantic Tobacco Grower 5-4-5	5-4-5	South Windsor
	F. A. Bartlett Tree Expert Co., Stamford, Conn.		
3884	Bartlett's Green Tree Food	6-8-4	Stamford
4126	Bartlett's Green Tree Food	6-8-4	Stamford

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
In nitrates.	In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
%	%	%	%	%	%	%	%	%	%	%	
1.60	2.62	0.19	0.55	4.96	6.03	0.45	6.60	6.15	3.88	3.88	4175
0.36	2.45	0.66	0.46	3.93	4.78	0.63	8.65	8.02	6.56	6.56	4090
0.51	1.82	0.59	0.50	3.42	4.16	0.65	9.00	8.35	6.71	6.71	3933
0.48	0.54	0.14	2.77	3.93	4.78	0.13	3.80	3.67	0.58	5.82	4087
0.12	1.00	0.48	0.65	2.25	2.74	2.20	10.31	8.11	3.05	3.05	3880
0.00	1.35	0.43	0.14	1.92	2.33	1.38	13.36	11.98	4.32	4.32	3885
0.79	1.02	0.42	0.66	2.89	3.51	1.93	9.73	7.80	3.07	3.07	3992
0.84	2.90	0.28	0.16	4.18	5.08	0.85	9.05	8.20	7.14	7.14	3985
0.18	1.86	0.18	3.80	6.02	7.32	0.38	7.70	7.32	1.63	7.19	4433
0.84	2.08	0.25	0.30	3.47	4.22	1.28	9.43	8.15	4.00	4.00	3990
1.50	0.10	0.42	1.80	3.82	4.66	1.75	9.93	8.18	1.53	7.61	3991
2.39	0.98	0.24	0.09	3.70	4.50	0.88	9.63	8.75	9.60	9.60	4436
0.06	1.02	0.15	2.71	3.94	4.79	0.30	5.95	5.65	0.77	5.91	4169
1.07	7.07	0.03	0.06	8.23	10.01	0.25	3.85	3.60	8.28	8.28	3995
0.19	1.26	0.48	0.61	2.54	3.09	0.97	8.36	7.39	3.91	3.91	4161
0.13	1.18	0.46	0.71	2.48	3.02	0.93	8.89	7.96	4.24	4.24	4606
0.82	1.12	0.56	0.72	3.22	3.91	0.69	8.58	7.89	4.26	4.26	3987
0.82	1.24	0.56	0.62	3.24	3.94	0.78	8.70	7.92	4.21	4.21	4222
0.50	1.26	0.98	0.64	3.38	4.11	1.10	7.60	6.50	10.93	10.93	4429
0.94	1.66	0.51	0.75	3.86	4.69	0.83	8.90	8.07	7.06	7.06	3986
1.00	1.53	0.60	0.77	3.90	4.74	1.20	8.80	7.60	6.26	6.26	4223
0.70	0.10	0.26	3.09	4.15	5.05	0.50	5.00	4.50	0.48	5.41	4162
0.16	0.90	0.20	0.57	1.83	2.22	0.75	8.70	7.95	2.12	2.12	4428
1.57	0.54	0.70	0.49	3.30	4.01	1.28	9.39	8.11	6.71	6.71	4407
1.31	0.89	0.56	1.55	4.31	5.24	1.83	8.58	6.75	1.47	17.32	4439
0.65	0.03	0.46	0.53	1.67	2.03	1.41	9.55	8.14	2.04	2.04	4438
0.52	1.61	0.60	0.54	3.27	3.98	1.18	9.40	8.22	3.88	3.88	4164
1.67	0.07	0.51	1.89	4.14	5.03	0.93	5.68	4.75	0.23	5.55	4408
1.64	0.09	0.38	2.03	4.14	5.03	0.85	5.85	5.00	0.31	5.00	4669
0.03	3.79	0.04	0.79	4.65	5.65	3.61	10.18	6.57	4.02	4.02	3884
0.15	4.40	0.12	0.75	5.42	6.59	2.10	8.20	6.10	5.33	5.33	4126

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Berkshire Fertilizer Co., Bridgeport, Conn.		
4224	Berkshire Complete Fertilizer	3-8-3	Chester
4437	Berkshire Complete Tobacco	5-4-5	Hazardville
4435	Berkshire Economical Grass Fertilizer	10-3-8	Ellington
4667	Berkshire Economical Grass Fertilizer	10-3-8	Rockville
3993	Berkshire Grass Special	7-6-5	New Canaan
3989	Berkshire Long Island Special	5-8-7	Highwood
3988	Berkshire Market Garden Fertilizer	4-8-4	Highwood
3994	Berkshire Potato and Vegetable Phosphate	2-9-3	New Canaan
4405	Berkshire Tobacco Special	7-4-7	Suffield
4607	Berkshire Starter 10% Potash	5-8-10	Ellington
4683	Berkshire Starter 10% Potash	5-8-10	Rockville
	Frank E. Boardman, Middletown, Conn.		
4684	Boardman's Complete Fertilizer, Potato and General Use	4-7-4	Middletown
4689	Boardman's Tobacco Fertilizer	4-7-4	Middletown
	Amos D. Bridge's Sons, Hazardville, Conn.		
4220	Corn, Onion and Potato and General Use	4-8-4	Hazardville
4485	Special Tobacco Fertilizer	5-4-5	Hazardville
4688	Special Tobacco Fertilizer	5-4-5	Hazardville
	E. D. Chittenden Co., Bridgeport, Conn.		
4406	Complete Grain 3% Potash	2-9-3	Bloomfield
4409	High Grade Potato with 7% Potash	5-8-7	Abington
4242	High Grade Tobacco	6.5-3-7.5	Glastonbury
4243	Potato Special	4-8-4	Glastonbury
4234	Tobacco Special	5-4-5	Glastonbury
	E. B. Clark Seed Co., Milford, Conn.		
3858	Special Mixture for General Use	4-8-4	Branford
3856	Special Mixture with 6% Potash	4-8-6	Branford
3857	Superphosphate	5-8-7	Branford
3855	Tip Top Brand	5-10-5	Branford
4682	Tip Top Brand	5-10-5	Orange
	C. A. Cowles, Plantsville, Conn.		
4402	Cowles' Complete Corn, Potato and Onion Fertilizer	4-8-4	Plantsville
	Davey Tree Expert Co., Kent, Ohio.		
4685	Davy Tree Food	7-8-3.6	Greenwich

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

	Nitrogen.					Phosphoric Acid.			Potash.		
	In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total.	Ammonia equivalent to total nitrogen.	Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	Station No.
%	%	%	%	%	%	%	%	%	%	%	
87	1.75	0.33	0.44	3.39	4.12	0.48	9.02	8.54	3.20	3.20	4224
17	1.12	0.69	2.56	4.54	5.52	0.48	5.35	4.87	1.10	5.73	4437
81	3.64	0.34	2.03	8.82	10.72	3.28	8.40	5.12	9.72	9.72	4435
94	4.01	1.53	2.18	9.66	11.74	3.70	8.90	5.20	8.06	8.06	4667
35	1.66	0.60	0.89	6.50	7.90	1.96	7.59	5.63	4.99	4.99	3993
53	2.50	0.28	0.92	4.23	5.14	0.55	8.85	8.30	7.00	7.00	3989
09	2.32	0.18	0.80	3.39	4.12	0.60	9.12	8.52	5.33	5.33	3988
04	1.56	0.09	0.23	1.92	2.33	0.50	10.15	9.65	3.43	3.43	3994
27	1.69	0.56	3.58	6.10	7.42	0.20	5.05	4.85	1.21	8.18	4405
01	3.01	0.03	1.39	4.44	5.40	1.25	9.88	8.63	2.11	10.74	4607
00	2.44	0.06	1.75	4.25	5.17	1.00	9.83	8.83	2.34	11.15	4683
58	1.36	0.67	1.04	3.65	4.44	0.87	7.70	6.83	4.85	4.85	4684
12	1.30	1.14	1.58	3.14	3.82	0.63	7.65	7.02	1.22	5.98	4689
94	1.20	0.52	0.79	3.45	4.19	1.18	9.55	8.37	4.33	4.33	4220
18	1.11	0.33	2.69	4.31	5.24	0.68	5.70	5.02	0.45	5.67	4485
11	1.13	0.18	2.84	4.26	5.18	0.55	5.65	5.10	0.39	6.32	4688
9	1.20	0.34	0.33	1.96	2.38	0.45	9.63	9.18	3.86	3.86	4406
0	3.50	0.37	0.33	4.20	5.11	0.20	8.63	8.43	7.81	7.81	4409
0	3.29	0.34	1.77	5.40	6.57	0.28	4.10	3.82	0.69	8.60	4242
6	3.20	0.26	0.80	4.32	5.25	0.30	8.19	7.89	4.45	4.45	4243
0	2.08	0.26	1.45	3.89	4.73	0.33	5.78	5.45	2.55	5.57	4234
5	2.41	0.15	0.60	3.21	3.90	0.83	8.63	7.80	4.22	4.22	3858
9	2.81	0.23	0.39	3.52	4.28	1.13	9.23	8.10	5.88	5.88	3856
6	2.81	0.05	0.81	4.13	5.02	2.04	9.49	7.45	7.04	7.04	3857
2	2.88	0.23	0.27	4.00	4.86	1.10	11.01	9.91	5.22	5.22	3855
4	2.58	0.53	0.83	3.98	4.84	0.56	10.45	9.89	6.39	6.39	4682
0	1.32	0.46	0.94	3.52	4.28	1.33	9.98	8.65	4.41	4.41	4402
7	3.88	0.15	1.52	5.72	6.95	4.20	14.05	9.85	3.40	3.40	4685

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **Eastern States Farmers' Exchange, Springfield, Mass.**		
4233	Eastern States 3-12-3	3-12-3	Seymour
4244	Eastern States 4-8-10	4-8-10	Farmington
4240	Eastern States 5-8-7	5-8-7	North Haven
4241	Eastern States 5-10-5	5-10-5	Guilford
4403	Eastern States 8-6-6	8-6-6	North Haven
4483	Eastern States 8-16-20	8-16-20	Farmington
4239	Eastern States 10-16-14	10-16-14	Farmington
	Essex Fertilizer Co., Boston, Mass.		
4478	Essex A1 Superphosphate 2-8-2	2-8-2	Wallingford
4598	Essex Complete Manure 5-8-7	5-8-7	Wallingford
4283	Essex Fish Fertilizer for All Crops 3-8-4	3-8-4	Wallingford
4280	Essex Market Garden 4-8-4	4-8-4	South Manchester
4281	Essex Potato Phosphate 4-8-7	4-8-7	South Manchester
	L. T. Frisbie Co., New Haven, Conn.		
3850	Frisbie's 5-8-7	5-8-7	Wilson
4008	Frisbie's Corn and Grain Fertilizer 2-8-2	2-8-2	Danbury
4481	Frisbie's Market Garden 4-8-7	4-8-7	New Britain
4480	Frisbie's Special 3-8-4	3-8-4	New Britain
4009	Frisbie's Special Vegetable and Potato Grower 4-8-4	4-8-4	Danbury
4486	Frisbie's Tobacco Grower 5-4-5	5-4-5	Buckland
4422	Frisbie's Tobacco Manure 5-8-6	5-8-6	Burnside
4479	Frisbie's Top Dresser 7-6-5	7-6-5	Wethersfield
	A. W. Higgins, South Deerfield, Mass.		
4465	Old Deerfield 3-10-6	3-10-6	Suffield
4651	Old Deerfield 4-8-4	4-8-4	Madison
4601	Old Deerfield 5-8-7	5-8-7	Madison
4600	Old Deerfield 10-16-14	10-16-14	Madison
4464	Old Deerfield Tobacco Fertilizer 7-4-7	7-4-7	Suffield
	International Agricultural Corp., Boston, Mass.		
4466	I. A. C. Connecticut Valley Tobacco Special	7-4-7	West Suffield
4454	I. A. C. Crop Grower 5-8-7	5-8-7	West Cheshire
4285	I. A. C. Ideal	4-8-4	Cromwell
4287	I. A. C. Multiple Strength 8-12-20	8-12-20	Cromwell
4468	I. A. C. New England Special	2-12-4	East Granby
4469	I. A. C. Tobacco Producer	5-4-5	East Granby
4648	I. A. C. Top Dresser 7-6-5	7-6-5	Cromwell

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
In nitrates.	In ammonia.	Organic water-soluble.	Organic water-*insoluble.*	Total.		*Citrate-insoluble.*	Total.	So-called "*Available.*"	As muriate.	Total.	
%	%	%	%	%	%	%	%	%	%	%	
0.40	1.20	0.39	0.51	2.50	3.04	0.57	12.15	11.58	3.43	3.43	4233
0.27	2.27	0.52	0.60	3.66	4.45	1.18	9.48	8.30	9.81	9.81	4244
0.06	2.58	0.57	0.74	3.95	4.77	0.98	9.01	8.03	7.29	7.29	4240
0.02	2.94	0.55	0.55	4.06	4.94	0.78	10.46	9.68	5.26	5.26	4241
0.33	4.16	0.93	0.96	6.38	7.76	0.68	8.25	7.57	6.11	6.11	4403
0.50	4.88	0.31	0.73	6.42	7.81	0.48	16.90	16.42	13.85	13.85	4483
1.10	6.16	0.25	0.86	8.37	10.18	0.45	15.90	15.45	13.52	13.52	4239
0.08	0.81	0.37	0.57	1.83	2.22	0.90	9.73	8.83	2.13	2.13	4478
0.43	3.00	0.14	0.58	4.15	5.05	0.85	9.40	8.55	7.22	7.22	4598
0.18	1.63	0.16	0.56	2.53	3.08	0.76	9.02	8.26	4.03	4.03	4283
0.40	1.84	0.37	0.79	3.40	4.13	0.56	8.74	8.18	4.17	4.17	4280
0.41	1.91	0.40	0.66	3.38	4.11	0.78	8.90	8.12	6.86	6.86	4281
0.22	2.80	0.49	0.60	4.11	5.00	0.99	8.90	7.91	6.95	6.95	3850
0.14	0.85	0.33	0.60	1.92	2.33	0.88	9.55	8.67	2.17	2.17	4008
1.34	0.70	0.75	0.49	3.28	3.99	1.40	9.73	8.33	6.59	6.59	4481
1.35	0.04	0.62	0.51	2.52	3.06	1.44	9.10	7.66	4.30	4.30	4480
0.36	2.25	0.27	0.40	3.28	3.99	0.55	9.00	8.45	3.91	3.91	4009
1.53	0.09	0.42	1.98	4.02	4.89	0.80	5.65	4.85	0.17	5.56	4486
1.88	0.00	0.79	1.61	4.28	5.20	1.15	10.83	9.68	0.74	6.27	4422
2.68	0.64	1.32	1.01	5.65	6.87	1.78	7.70	5.92	5.06	5.06	4479
0.16	1.50	0.56	0.58	2.80	3.40	0.93	10.28	9.35	6.40	6.40	4465
0.57	1.41	0.59	0.97	3.54	4.30	1.30	9.50	8.20	5.46	5.46	4651
0.80	1.23	0.54	1.28	3.85	4.68	0.83	8.46	7.63	8.12	8.12	4601
0.72	5.07	0.90	1.70	8.39	10.20	0.88	18.25	17.37	14.52	14.52	4600
1.56	0.50	0.50	3.28	5.84	7.10	0.38	6.00	5.62	0.66	8.41	4464
0.15	1.91	0.45	3.21	5.72	6.95	0.13	4.23	4.10	0.76	7.10	4466
0.37	2.10	0.48	1.02	3.97	4.83	0.18	8.25	8.07	6.93	6.93	4454
0.26	1.66	0.59	0.86	3.37	4.10	0.23	8.40	8.17	4.28	4.28	4285
0.60	4.41	0.69	0.84	6.54	7.95	0.65	12.75	12.10	2.30	20.44	4287
0.37	0.93	0.00	0.60	1.90	2.31	0.28	12.43	12.15	3.93	3.93	4468
0.18	1.37	0.07	2.42	4.04	4.91	0.13	4.08	3.95	0.65	5.01	4469
1.34	2.18	0.51	1.31	5.34	6.49	0.23	7.03	6.80	1.42	5.04	4648

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Lowell Fertilizer Co., Boston, Mass.		
3848	Lowell Animal Brand, A High Grade Manure for All Crops 3-8-4	3-8-4	Cheshire
4686	Lowell Animal Brand, A High Grade Manure for All Crops 3-8-4	3-8-4	Southington
4007	Lowell Bone Fertilizer 2-8-2	2-8-2	Saugatuck
4005	Lowell Corn and Vegetable 4-8-4	4-8-4	Southport
4006	Lowell Market Garden Manure 5-8-7	5-8-7	Southport
4278	Lowell Potato Grower 4-6-10	4-6-10	Shelton
3849	Lowell Potato Phosphate 4-8-7	4-8-7	Cheshire
4463	Lowell Tobacco 5-4-5	5-4-5	Warehouse Point
3847	Lowell Top Dressing 7-6-5	7-6-5	Cheshire
4674	Lowell Top Dressing 7-6-5	7-6-5	Wethersfield
	Mapes Formula and Peruvian Guano Co., New York.		
4459	The Mapes Connecticut Valley Special	6-4-7	Hazardville
3904	The Mapes Corn Manure	3-8-3	Meriden
4462	The Mapes General Tobacco Manure	5-4-5	West Suffield
4282	The Mapes General Truck Manure	5-6-5	Hazardville
3896	The Mapes General Use Manure	3-6-4	Windsor Locks
4496	The Mapes Onion Manure	4-6-4	Hazardville
3897	The Mapes Potato Manure	4-7-5	Windsor Locks
4492	The Mapes Special Trucker	5-8-7	Hartford
4498	The Mapes Tobacco Ash Constituents	1-4-15	Suffield
4497	The Mapes Tobacco Manure Wrapper Brand	7.5-2-10.5	Hazardville
4494	The Mapes Tobacco Starter Improved	5-6-1	Hartford
4493	The Mapes Top Dresser	10-4-2	Hartford
	Mehmel & Sarvi, Plantsville, Conn.		
4680	Mehmel's Complete Corn, Potato and Onion Fertilizer	4-8-4	Plantsville
	New England Fertilizer Co., Boston, Mass.		
3900	New England Corn Phosphate 2-8-2	2-8-2	Rockville
4004	New England Market Garden 5-8-7	5-8-7	Rockville
3899	New England Potato and Vegetable Manure 4-8-4	4-8-4	Meriden
4653	New England Potato Phosphate 4-8-7	4-8-7	Unionville
4500	New England Tobacco 5-4-5	5-4-5	Warehouse Point
3898	New England Superphosphate, A High Grade Fertilizer for All Crops 3-8-4	3-8-4	Meriden

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

	Nitrogen.				Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
	In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
	%	%	%	%	%	%	%	%	%	%	
14	1.60	0.05	0.62	2.41	2.93	0.93	9.17	8.24	3.69	3.69	3848
33	1.79	0.26	0.54	2.62	3.19	0.90	9.20	8.30	4.07	4.07	4686
16	0.82	0.23	0.55	1.76	2.14	0.85	9.43	8.58	2.04	2.04	4007
54	2.36	0.02	0.48	3.50	4.26	0.73	8.95	8.22	3.91	3.91	4005
00	2.77	0.75	0.61	4.13	5.02	0.73	9.50	8.77	6.80	6.80	4006
26	1.56	0.68	1.08	3.58	4.35	1.08	7.50	6.42	9.72	9.72	4278
19	1.75	0.40	0.82	3.46	4.21	0.78	8.87	8.09	6.95	6.95	3849
00	0.12	0.72	2.30	4.14	5.03	1.13	5.90	4.77	1.26	5.48	4463
00	5.60	0.05	0.19	5.84	7.10	0.10	6.37	6.27	4.75	4.75	3847
09	5.57	0.09	0.17	5.92	7.20	0.30	6.70	6.40	5.19	5.19	4674
55	0.29	0.51	2.17	5.62	6.83	0.88	5.43	4.55	0.68	7.56	4459
2	2.10	0.08	0.76	3.66	4.45	2.50	10.03	7.53	3.68	3.68	3904
52	0.14	0.61	2.13	4.40	5.35	1.03	5.80	4.77	0.45	6.02	4462
91	1.51	1.33	0.90	4.35	5.29	0.85	8.90	8.05	4.65	5.42	4282
7	1.00	0.21	0.68	3.06	3.72	2.38	9.50	7.12	5.15	5.15	3896
71	1.52	0.99	0.48	3.70	4.50	2.53	9.13	6.60	0.27	4.37	4496
9	1.58	0.17	0.84	3.78	4.60	0.90	9.28	8.38	4.98	4.98	3897
0	1.74	0.13	0.76	4.33	5.26	2.85	10.88	8.03	7.38	7.38	4492
02	0.12	0.17	0.53	0.84	1.02	1.50	6.73	5.23	1.10	16.84	4498
21	0.24	0.70	3.17	6.32	7.68	1.25	5.60	4.35	1.09	11.38	4497
58	1.62	0.38	1.04	4.42	5.37	3.28	10.78	7.50	0.35	1.54	4494
28	2.00	0.25	0.66	8.19	9.96	1.10	7.23	6.13	0.23	2.47	4493
58	1.32	0.50	0.87	3.37	4.10	1.10	10.10	9.00	4.72	4.72	4680
5	0.80	0.19	0.64	1.68	2.04	0.83	9.55	8.72	1.93	1.93	3900
5	2.89	0.52	0.67	4.43	5.39	0.55	8.60	8.05	7.37	7.37	4004
15	2.05	0.28	0.46	3.24	3.94	0.73	8.85	8.12	4.07	4.07	3899
17	1.90	0.70	0.71	3.48	4.23	0.83	9.25	8.42	6.98	6.98	4653
28	0.08	0.17	2.45	3.98	4.84	0.50	5.30	4.80	0.69	6.22	4500
98	1.48	0.25	0.53	2.34	2.84	0.95	9.45	8.50	3.67	3.67	3898

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Olds & Whipple, Inc., Hartford, Conn.		
4507	O & W Complete Market Garden Fertilizer	4-8-4	South Manchester
4502	O & W Complete Tobacco Fertilizer	5-4-5	Rockville ....
4687	O & W Complete Tobacco Fertilizer	5-4-5	Hazardville ......
4121	O & W Grain and General Crop Fertilizer ..	2-9-3	South Windsor ...
3903	O & W Grass Fertilizer	6-6-4	Hartford ....
4512	O & W High Grade Vegetable and Potato Fertilizer	5-8-7	Plantsville ....
4516	O & W High Grade Starter and Potash Compound	5-4-15	Burnside ....
4495	O & W Tobacco Fertilizer, Blue Label Brand	6-3-6	Manchester ......
	Parmenter & Polsey Fertilizer Co., Boston, Mass.		
4646	P & P Maine Potato Fertilizer 4-6-10	4-6-10	Wallingford .....
4517	P & P Plymouth Rock Brand For All Crops 3-8-4	3-8-4	Plainville ....
	Piedmont-Mt. Airy Guano Co., Baltimore, Md.		
4509	Harvest Brand 3-8-4	3-8-4	Seymour ....
4508	Harvest Brand 4-8-4	4-8-4	Seymour ....
4510	Harvest Brand 4-6-10	4-6-10	Seymour ....
3919	Harvest Brand 5-8-7	5-8-7	Seymour ....
4511	Harvest Brand 6-8-6	6-8-6	Seymour ....
	Frank S. Platt Co., New Haven, Conn.		
4513	Platco Special 5-8-7	5-8-7	New Haven ......
	Rackliffe Bros. Co., New Britain, Conn.		
4049	Rackliffe Complete Corn, Potato and Onion Fertilizer	4-8-4	New Britain ......
4050	Rackliffe High Grade Potato Fertilizer	5-8-7	New Britain ......
	The Rogers & Hubbard Co., Portland, Conn.		
3998	4-8-4	4-8-4	Hartford ....
4054	5-8-7	5-8-7	North Haven ....
4544	10-3-8	10-3-8	Rockfall ....
4119	Rogers & Hubbard's All Soils All Crops Fertilizer	4-10-4	Highwood ....
4051	Garden Fertilizer	2-8-4	Hartford ....
3999	Hubbard's "Bone Base" Fertilizer for Seeding Down	3-5-6	Portland ....

Containing Nitrogen, Phosphoric Acid and Potash—*Continued.*

Nitrogen.						*Phosphoric Acid.*			*Potash.*		
In nitrates.	In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total.	Ammonia equivalent to total nitrogen.	Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	Station No.
%	%	%	%	%	%	%	%	%	%	%	
.88	1.16	0.44	0.86	3.34	4.06	1.20	9.73	8.53	4.74	4.74	4507
.05	1.13	0.18	2.84	4.20	5.11	0.60	6.20	5.60	0.40	6.00	4502
.16	1.02	0.06	2.92	4.16	5.06	0.48	5.95	5.47	0.47	5.75	4687
.26	1.02	0.07	0.42	1.77	2.15	1.83	11.45	9.62	0.47	3.15	4121
1.71	2.05	0.56	1.00	5.32	6.47	1.10	7.43	6.33	4.36	4.36	3903
1.11	1.57	0.48	1.03	4.19	5.09	1.33	10.13	8.80	0.45	7.94	4512
.86	1.04	0.05	2.30	4.25	5.17	0.60	5.85	5.25	1.08	16.25	4516
.15	1.10	0.07	3.90	5.22	6.35	0.35	4.20	3.85	0.28	6.93	4495
.24	1.38	0.74	0.98	3.34	4.06	0.93	7.50	6.57	9.74	9.74	4646
.05	1.78	0.30	0.54	2.67	3.25	0.75	9.05	8.30	3.73	3.73	4517
.17	1.47	0.29	0.75	2.68	3.26	1.23	9.35	8.12	4.28	4.28	4509
.01	2.11	0.37	0.67	3.16	3.84	1.15	9.18	8.03	3.96	3.96	4508
.11	2.69	0.28	0.42	3.50	4.26	0.90	7.95	7.05	7.50	7.50	4510
.10	3.55	0.37	0.64	4.66	5.67	0.80	8.23	7.43	6.95	6.95	3919
.13	3.35	0.57	0.30	4.35	5.29	0.93	9.75	8.82	5.50	5.50	4511
.89	0.65	0.96	0.58	4.08	4.96	1.33	9.50	8.17	6.94	6.94	4513
.68	2.02	0.00	0.68	3.38	4.11	0.65	9.28	8.63	5.12	5.12	4049
.94	1.55	1.01	1.05	4.55	5.53	1.53	10.15	8.62	0.45	7.78	4050
.06	1.42	0.56	0.21	3.25	3.95	1.13	9.93	8.80	4.13	4.13	3998
.30	1.82	0.59	0.24	3.95	4.80	0.98	9.43	8.45	6.58	6.58	4054
1.43	5.01	0.56	0.30	7.30	8.88	0.48	4.15	3.67	8.24	8.24	4544
.15	1.92	0.77	0.33	3.17	3.85	1.25	11.48	10.23	4.28	4.28	4119
.59	0.47	0.64	0.20	1.90	2.31	0.60	8.87	8.27	4.13	4.13	4051
.22	0.15	0.62	1.77	2.76	3.36	7.55	13.25	5.70	6.18	6.18	3999

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **The Rogers & Hubbard Co., Portland, Conn.**—*Concluded.*		
4000	Hubbard's "Bone Base" Oats and Top Dressing	10-3-8	Highwood
4003	Hubbard's "Bone Base" Soluble Corn and General Crops Manure	3-8-6	Branford
4055	Hubbard's "Bone Base" Soluble Potato Manure	6-8-5	Branford
4515	Hubbard's "Bone Base" Soluble Tobacco Manure	6-8-10	Glastonbury
4518	Rogers & Hubbard's Climax Tobacco Brand	5-4-5	Granby
4056	Rogers & Hubbard's Corn and Grain Fertilizer	1-10-3	New Britain
4545	Rogers & Hubbard's High Potash Fertilizer	3-8-10	Torrington
4542	Rogers & Hubbard's Potato Fertilizer	2-10-4	Willimantic
4514	Rogers & Hubbard's Tobacco Grower, Vegetable Formula	6-4-4	Glastonbury
	F. S. Royster Guano Co., Baltimore, Md.		
4538	Royster's Gem Guano	2-12-4	Watertown
4540	Royster's Quality Trucker	4-8-7	Plainville
4546	Royster's Rational Guano	1-9-4	New Canaan
4543	Royster's Spearhead Guano	3-8-4	Thompsonville
4537	Royster's Top Dresser	7-6-5	Waterbury
4541	Royster's Truckers' Delight	4-8-4	Plainville
4539	Royster's 5% Truck Guano	5-8-7	Trumbull
4547	Royster's Valley Tobacco Formula	5-4-5	Simsbury
	M. L. Shoemaker & Co., Philadelphia, Pa.		
4695	5-8-7 Potato Special	5-8-7	New Milford
4570	Swift-Sure Crop Grower	4-8-4	Glastonbury
4580	Shoemaker's "Swift-Sure" Special Tobacco Formula	4-8-5	New Milford
4569	Shoemaker's "Swift-Sure" Tobacco and General Use	3-10-3	Glastonbury
	Springfield Rendering Co., Springfield, Mass.		
4571	Springfield Animal Brand 3-8-4	3-8-4	Stafford Springs
4576	Springfield Market Garden Grower and Top Dresser 5-8-7	5-8-7	Hazardville
4572	Springfield Special Potato, Onion and Vegetable 4-8-4	4-8-4	Stafford Springs

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Nitrogen.				Ammonia equivalent to *total nitrogen.*	Phosphoric Acid.			Potash.		Station No.
In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
%	%	%	%	%	%	%	%	%	%	
0.03	0.45	0.30	8.36	10.16	3.38	9.15	5.77	5.69	8.08	4000
1.29	0.67	0.50	2.70	3.28	2.23	10.33	8.10	6.31	6.31	4003
1.95	1.26	0.82	5.00	6.08	1.98	10.15	8.17	0.80	4.83	4055
1.86	1.37	0.74	4.90	5.96	1.55	10.08	8.53	0.74	10.41	4515
0.14	0.05	2.82	4.12	5.01	0.40	5.60	5.20	0.69	5.54	4518
0.19	0.41	0.25	0.92	1.12	0.98	11.33	10.35	3.12	3.12	4056
1.29	0.69	0.32	2.44	2.97	0.85	8.80	7.95	10.72	10.72	4545
0.66	0.79	0.37	1.95	2.37	1.05	11.28	10.23	4.38	4.38	4542
0.11	0.36	3.79	4.99	6.07	0.75	4.54	3.79	0.43	4.32	4514
0.91	0.10	0.69	1.74	2.11	1.12	12.85	11.73	4.31	4.31	4538
2.08	0.16	0.97	3.21	3.90	1.10	9.58	8.48	6.38	6.38	4540
0.43	0.00	0.38	0.86	1.05	0.75	9.80	9.05	4.14	4.14	4546
1.44	0.04	0.82	2.43	2.95	1.03	9.20	8.17	4.11	4.11	4543
2.74	0.62	1.58	5.52	6.71	0.73	7.18	6.45	5.02	5.02	4537
1.99	0.19	1.03	3.22	3.91	1.31	8.90	7.59	4.00	4.00	4541
1.02	0.13	0.63	1.81	2.20	1.05	9.53	8.48	6.56	6.56	4539
0.73	0.16	2.34	3.52	4.28	0.31	4.20	3.89	0.40	5.88	4547
1.53	0.69	1.19	3.87	4.71	1.58	9.80	8.22	8.63	8.63	4695
1.50	0.48	0.63	3.05	3.71	0.98	9.85	8.87	5.11	5.11	4570
1.34	0.19	1.36	3.37	4.10	1.28	9.29	8.01	0.52	5.85	4580
1.04	0.34	1.00	2.80	3.40	1.35	11.16	9.81	3.49	3.49	4569
1.43	0.52	0.54	2.58	3.14	0.68	8.97	8.29	4.00	4.00	4571
2.10	0.85	0.74	4.04	4.91	0.88	9.43	8.55	6.62	6.62	4576
1.71	0.70	0.50	3.32	4.04	0.70	9.08	8.38	3.86	3.86	4572

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling
	Sampled by Station:		
	I. P. Thomas & Son, Philadelphia, Pa.		
4015	7% Guano	7-6-5	Highwood
4023	Economy Fertilizer	3-12-3	Plainville
3853	High Grade Potato Manure 4-8-10	4-8-10	North Haven
4017	Long Island Special	4-8-7	Highwood
4026	I. P. Thomas 5-8-7	5-8-7	Milford
3852	Thomas Fish and Potash	5-8-5	North Haven
4025	Thomas Fish and Potash	5-8-5	Milford
4577	Thomas Tobacco Grower 5-4-5 (Sulphate of Potash)	5-4-5	Simsbury
3854	Tip-Top Superphosphate	3-10-6	North Haven
4016	Tip-Top Superphosphate	3-10-6	Highwood
4020	Truckers' High Grade	4-8-4	Ansonia
4019	Victor Potash Fertilizer 2-8-5	2-8-5	Ansonia
	Triton Oil and and Fertilizer Co., New York.		
4652	Triton 4-8-4 Fertilizer	4-8-4	New London
4697	Triton 4-8-7	4-8-7	New London
	U. S. Fertilizer Chemical Co., New York.		
4579	Volco Ideal	2.4-5-8	Whitneyville
	United States Guano Co., Baltimore, Md.		
4638	Standard United States 3-9-2	3-9-2	Torrington
4633	Standard United States 5-4-5	5-4-5	New Britain
4018	Standard United States 5-8-5	5-8-5	North Haven
4022	Standard United States Evergreen Fish Guano	4-8-4	Guilford
4021	Standard United States Fish, Bone and Potash	5-8-7	Guilford
4052	Standard United States Mammoth Potato Grower	2-8-10	North Haven
4637	Standard United States Old Fertility	2-8-3	Torrington
4053	Standard United States Royal Potato Grower	4-8-7	North Haven
4654	Standard United States Royal Potato Grower	4-8-7	Torrington
	Virginia-Carolina Chemical Co., New York.		
4628	V-C Aroostook Potato Grower	5-8-7	North Haven
4629	V-C Double Owl Brand	4-8-7	North Haven
4632	V-C Rescue Brand	3-8-4	North Haven
4631	V-C Super-Thirty	6-18-6	North Haven
	The Wilcox Fertilizer Co., Mystic, Conn.		
4060	Wilcox 5-8-7 Fertilizer	5-8-7	Willimantic
4291	Wilcox 5-10-5 Fertilizer	5-10-5	Woodstock

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

	Nitrogen.				Ammonia equivalent to *total nitrogen.*	Phosphoric Acid.			Potash.		
	In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	
3	3.82	0.00	0.63	5.68	6.91	1.10	7.80	6.70	5.39	5.39	4015
0	1.22	0.43	0.70	2.65	3.22	3.27	13.78	10.51	3.10	3.55	4023
9	1.52	0.22	0.65	3.28	3.99	2.28	10.33	8.05	9.45	9.45	3853
2	1.58	0.40	0.65	3.35	4.07	2.28	10.30	8.02	7.04	7.04	4017
0	2.28	0.87	0.90	4.35	5.29	2.17	9.89	7.72	6.66	7.05	4026
1	1.97	1.05		3.83	4.66	2.35	10.55	8.20	4.70	4.70	3852
0	2.20	0.38	0.81	4.19	5.09	2.63	10.20	7.57	5.02	5.02	4025
9	0.96	0.30	2.05	4.10	4.98	1.50	9.03	7.53	0.64	5.65	4577
0	1.05	0.21	0.76	2.52	3.06	2.75	12.60	9.85	6.18	6.18	3854
4	1.18	0.12	0.80	2.54	3.09	3.03	12.79	9.76	6.20	6.20	4016
0	1.55	0.26	0.65	3.26	3.96	2.15	10.38	8.23	3.93	3.93	4020
5	0.75	0.03	0.62	1.85	2.25	1.80	9.93	8.13	4.90	4.90	4019
4	1.24	0.69	0.93	3.30	4.01	1.00	9.23	8.23	4.88	4.88	4652
1	1.18	0.56	0.89	3.24	3.94	1.13	8.58	7.45	7.05	7.05	4697
9	1.77	0.03	0.01	1.90	2.31	0.40	5.17	4.77	0.00	4.94	4579
4	1.28	0.21	0.92	2.45	2.98	1.03	9.29	8.26	3.09	3.09	4638
4	0.20	0.19	3.29	3.72	4.52	0.38	5.65	5.27	0.00	6.12	4633
4	2.24	0.41	1.29	4.28	5.20	1.23	9.33	8.10	4.95	4.95	4018
2	2.28	0.29	0.61	3.30	4.01	0.70	8.95	8.25	4.52	4.52	4022
7	3.62	0.22	0.46	4.37	5.31	0.50	8.73	8.23	6.64	6.64	4021
4	1.30	0.07	0.47	1.98	2.41	0.63	8.85	8.22	9.86	9.86	4052
0	1.28	0.24	2.04	3.76	4.57	1.30	8.92	7.62	4.55	4.55	4637
2	3.38	0.08	0.80	4.48	5.45	0.72	8.78	8.06	5.86	5.86	4053
2	2.56	0.15	0.62	3.55	4.32	1.00	9.28	8.28	7.19	7.19	4654
1	3.53	0.31	0.16	4.11	5.00	0.65	8.61	7.96	7.05	7.05	4628
0	2.62	0.53	0.20	3.35	4.07	0.68	9.10	8.42	6.96	6.96	4629
8	2.10	0.08	0.27	2.63	3.20	1.02	8.90	7.88	4.17	4.17	4632
1	3.94	0.52	0.08	4.65	5.65	0.63	18.69	18.06	6.35	6.35	4631
0	1.50	0.27	1.12	4.29	5.22	0.55	9.02	8.47	5.97	7.10	4060
8	1.52	0.41	1.03	4.34	5.28	0.88	11.38	10.50	0.58	5.13	4291

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling
	Sampled by Station: **The Wilcox Fertilizer Co., Mystic, Conn.** —*Concluded.*		
4639	Wilcox 7-6-5 Top Dresser	7-6-5	Ellington
4059	Wilcox Corn Special	3-10-4	Willimantic
4290	Wilcox Corn Special	3-10-4	Woodstock
4634	Wilcox Fish and Potash (1924-25 Formula 4-8-4)	4-8-4	Mystic
4058	Wilcox Potato and Vegetable Phosphate	4-8-6	Willimantic
4293	Wilcox Potato and Vegetable Phosphate	4-8-6	Woodstock
4057	Wilcox Special 4-8-4 Fertilizer	4-8-4	Willimantic
	Wilson-Martin Co., Philadelphia, Pa.		
4184	Bantle's Wrapper Brand 7-4-7	7-4-7	Glastonbury
	S. D. Woodruff & Sons, Orange, Conn.		
3921	Woodruff's Home Mixed Fertilizer	4-8-6	Orange
	Worcester Rendering Co., Auburn, Mass.		
4608	Prosperity Brand Complete Dressing	6-6-4	Putnam
4605	Prosperity Brand Corn and Grain Fertilizer	2-8-2	Groton
4604	Prosperity Brand Market Garden Fertilizer	5-8-7	Groton
4609	Prosperity Brand Potato and Vegetable Fertilizer	4-8-4	Moosup
	Sampled by Purchaser: **F. A. Bartlett Tree Expert Co., Stamford, Conn.**		
3563	Bartlett's Green Tree Food	6-8-4	Greenwich
	C. & R. Sales Co., Worcester, Mass.		
4773	C. & R. Lawn and Shrub Fertilizer 6-5-5	6-5-5	Taftville
	Davey Tree Expert Co., Kent, Ohio.		
3562	Davey Tree Food	7-8-3	Greenwich
	U. S. Fertilizer Chemical Co., Inc., New York.		
3305	Volco Imperial Fertilizer	3-8-6	New York
3306	Volco Ideal Fertilizer	2-5-8	New York
3307	Volco Superior Fertilizer	3-5-7	New York

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Concluded.*

Nitrogen: In nitrates.	Nitrogen: In ammonia.	Nitrogen: Organic water-soluble.	Nitrogen: Organic water-insoluble.	Nitrogen: Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid: Citrate-insoluble.	Phosphoric Acid: Total.	Phosphoric Acid: So-called "Available."	Potash: As muriate.	Potash: Total.	Station No.
%	%	%	%	%	%	%	%	%	%	%	
1.74	2.36	0.82	1.16	6.08	7.39	0.93	7.28	6.35	3.81	5.00	4639
1.26	0.08	0.62	0.92	2.88	3.50	0.68	10.75	10.07	4.26	4.26	4059
1.26	0.08	0.71	0.93	2.98	3.62	0.83	10.61	9.78	4.48	4.48	4290
1.60	0.40	0.62	0.78	3.40	4.13	0.61	8.65	8.04	2.83	4.10	4634
1.85	0.07	0.78	0.82	3.52	4.28	0.90	9.00	8.10	3.77	4.88	4058
1.83	0.08	0.73	0.88	3.52	4.28	0.93	9.00	8.07	4.07	4.93	4293
0.98	1.36	0.58	0.62	3.54	4.30	0.48	8.74	8.26	4.17	4.17	4057
1.39	0.16	1.08	4.13	6.76	8.22	1.80	7.20	5.40	0.85	8.49	4184
1.70	0.00	0.06	1.30	3.06	3.72	0.33	7.82	7.49	6.68	6.68	3921
0.78	1.77	1.23	1.12	4.90	5.96	1.15	7.43	6.28	3.95	3.95	4608
0.07	0.87	0.47	0.52	1.93	2.35	0.77	8.79	8.02	2.20	2.20	4605
0.35	2.63	0.56	0.51	4.05	4.92	0.54	8.69	8.15	6.90	6.90	4604
0.35	1.73	0.53	0.62	3.23	3.93	0.57	8.56	7.99	3.94	3.94	4609
0.16	4.82	1.17		6.15	7.48	2.28	9.59	7.31	2.39	2.39	3563
0.15	0.63	0.44	3.90	5.12	6.22	1.73	7.73	6.00	5.50	5.50	4773
0.13	3.32	3.79		7.24	8.80	0.69	9.29	8.60	3.50	3.50	3562
0.04	2.92	0.00		2.96	3.60	0.52	9.11	8.59	0.00	5.10	3305
0.00	1.84	0.02		1.86	2.26	0.38	6.12	5.74	0.00	5.88	3306
0.00	3.23	0.05	0.04	3.32	4.04	0.32	5.32	5.00	0.00	5.74	3307

SPECIAL MIXTURES AND HOME MIXTURES.

Sixty-four samples have been analyzed for purchasers. These represent, generally, fertilizers mixed to order according to special formulas.

Analyses are given in Table XV.

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
			%	%	%	%	%	%	%	
	Sampled by Station:									
4420	....	Cornelius Ahearn, Stratford ...	4.17	5.07	1.60	10.88	9.28	....	5.31	4420
4421	....	Cornelius Ahearn, Stratford ...	2.43	2.95	1.15	11.25	10.10	....	5.00	4421
4663	Atlantic Packing Co., New Haven	Frank Roberts, Silver Lane	5.73	6.97	0.53	6.30	5.77	....	8.26	4663
4640	L. T. Frisbie Co., New Haven	Hickey Bros., East Hartford ..	4.71	5.73	1.33	6.73	5.40	0.64	9.36	4640
4641	L. T. Frisbie Co., New Haven	Hickey Bros., East Hartford ..	4.80	5.84	0.83	5.83	5.00	1.32	8.68	4641
4672	L. T. Frisbie Co., New Haven	Manning & Kahn, Manchester ..	6.36	7.73	1.28	5.15	3.87	....	5.70	4672
4122	Olds & Whipple, Inc., Hartford	Leslie W. Newberry, South Windsor	3.22	3.91	0.95	6.50	5.55	....	5.81	4122
4123	Olds & Whipple, Inc., Hartford	Leslie W. Newberry, South Windsor	5.68	6.91	0.33	6.33	6.00	0.66	8.45	4123
4673	Olds & Whipple, Inc., Hartford	Manning & Kahn, Manchester ..	6.00	7.29	1.10	5.55	4.45	....	6.31	4673
4417	....	T. W. Ryan, Stratford	2.50	3.04	1.33	11.88	10.55	....	4.80	4417
4418	....	T. W. Ryan, Stratford	4.63	5.63	1.28	8.35	7.07	....	6.60	4418
	Sampled by Purchaser:									
3721	Formula AA	American Sumatra Tobacco Co., Bloomfield	7.06	8.58	0.47	3.32	2.85	....	1.32	3721
3586	Formula A	American Sumatra Tobacco Co., Bloomfield	5.18	6.30	0.78	5.00	4.22	0.19	6.88	3586

TABLE XV. ANALYSES OF SPECIAL MIXTURES AND HOME MIXTURES—*Continued.*

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
	Sampled by Purchaser:		%	%	%	%	%	%	%	
3834	Formula A	American Sumatra Tobacco Co., Bloomfield	5.20	6.32	0.73	4.98	4.25	....	7.10	3834
3833	Formula B	American Sumatra Tobacco Co., Bloomfield	6.32	7.68	0.73	4.68	3.95	....	5.84	3833
3657	Formula C	American Sumatra Tobacco Co., Bloomfield	6.07	7.38	0.66	3.92	3.26	....	5.72	3657
3658	Formula D	American Sumatra Tobacco Co., Bloomfield	5.80	7.05	0.51	3.80	3.29	....	4.75	3658
4758	Formula CC	American Sumatra Tobacco Co., Bloomfield	6.12	7.44	0.48	4.70	4.22	0.11	6.48	4758
4141	Formula A.G.	American Sumatra Tobacco Co., Bloomfield	5.19	6.31	0.70	4.78	4.08	0.15	7.12	4141
4142	Formula B.G.	American Sumatra Tobacco Co., Bloomfield	5.25	6.38	0.83	4.80	3.97	....	7.28	4142
3832	Formula C.G.	American Sumatra Tobacco Co., Bloomfield	5.62	6.83	0.63	4.23	3.60	....	7.56	3832
4135	Formula C.G.	American Sumatra Tobacco Co., Bloomfield	5.96	7.25	0.63	4.15	3.52	....	7.94	4135
4136	Formula D.G.	American Sumatra Tobacco Co., Bloomfield	5.74	6.98	0.43	3.95	3.52	....	5.86	4136
4138	Formula E	American Sumatra Tobacco Co., Bloomfield	5.58	6.78	0.25	4.48	4.23	0.74	5.78	4138
4790	Formula E	American Sumatra Tobacco Co., Bloomfield	5.70	6.93	1.45	6.83	5.38	0.20	6.30	4790
4140	Formula F	American Sumatra Tobacco Co., Bloomfield	5.76	7.00	0.23	4.80	4.57	0.78	6.31	4140

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	*Ammonia equivalent* to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
	Sampled by Purchaser:		%	%	%	%	%	%	%	
3831	Formula G	American Sumatra Tobacco Co., Bloomfield	6.44	7.83	0.65	4.45	3.80	....	6.68	3831
4137	Formula H	American Sumatra Tobacco Co., Bloomfield	6.02	7.32	0.73	6.25	5.52	0.49	5.75	4137
4139	Formula I	American Sumatra Tobacco Co., Bloomfield	6.51	7.91	0.83	5.03	4.20	0.48	6.27	4139
4143	Formula *Du Bons* I	American Sumatra Tobacco Co., Bloomfield	6.10	7.42	0.53	3.93	3.40	0.48	7.35	4143
4791	Formula P	American Sumatra Tobacco Co., Bloomfield	5.60	6.81	0.18	4.80	4.62	0.57	7.68	4791
4145	Fertilizer for Drill	American Sumatra Tobacco Co., Bloomfield	9.95	12.10	0.88	4.43	3.55	0.39	1.04	4145
4144	Tobacco Bed Fertilizer	American Sumatra Tobacco Co., Bloomfield	7.58	9.22	4.18	9.90	5.72	0.47	0.47	4144
3722	Mr. Hale's Mixture	American Sumatra Tobacco Co., Bloomfield	8.90	10.82	0.45	2.70	2.25	....	1.37	3722
4227	Welsh Farm Fertilizer	Allied Tobacco Co., Hartford	5.93	7.21	0.13	2.45	2.32	....	4.85	4227
4490	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	5.50	6.69	....	5.50	....	....	8.24	4490
4491	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	5.70	6.93	....	5.08	....	....	6.86	4491
2748	Berkshire Fertilizer Co., Bridgeport	E. N. Austin, Suffield	4.63	5.63	....	5.32	....	....	5.48	2748
4258	Berkshire Fertilizer Co., Bridgeport	Paul and Ed. Rostek, Melrose	6.40	7.78	0.58	7.95	7.37	....	9.52	4258

TABLE XV. ANALYSES OF SPECIAL MIXTURES AND HOME MIXTURES—*Continued.*

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
					Citrate-insoluble.	Total.	So-called "available."	As muriate.	Total.	
	Sampled by Purchaser:		%	%	%	%	%	%	%	
4304	Berkshire Fertilizer Co., Bridgeport	Tobacco Station, Windsor	4.58	5.57	0.30	5.20	4.90	....	5.99	4304
4302	The Mapes Formula & Peruvian Guano Co., New York	Tobacco Station, Windsor	4.52	5.50	0.90	6.08	5.18	0.66	5.73	4302
4660	Olds & Whipple, Inc., Hartford	L. B. Hass & Co., Hartford	5.98	7.27	0.48	9.18	8.70	0.33	11.10	4660
4661	Olds & Whipple, Inc., Hartford	L. B. Hass & Co., Hartford	7.38	8.97	0.45	7.35	6.90	0.70	7.10	4661
4452	Olds & Whipple, Inc., Hartford	Stephen Potwine, Warehouse Point	5.14	6.25	0.33	4.80	4.47	....	5.93	4452
4047	Olds & Whipple, Inc., Hartford	Harry E. Wells, Warehouse Point	4.08	4.96	0.08	8.68	8.60	1.10	14.38	4047
3930	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford	6.08	7.39	0.58	4.60	4.02	....	4.16	3930
3931	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford	6.41	7.79	0.45	4.50	4.05	....	4.26	3931
4128	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford	6.08	7.39	....	4.75	....	....	4.14	4128
4129	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford	5.79	7.04	....	4.85	....	....	4.20	4129
4130	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford	6.00	7.29	0.48	4.88	4.40	....	4.29	4130
4172	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford	5.09	6.19	0.53	6.65	6.12	....	6.00	4172

TABLE XV. ANALYSES OF SPECIAL MIXTURES AND HOME MIXTURES—*Concluded.*

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
	Sampled by Purchaser:		%	%	%	%	%	%	%	
4226	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford ..	5.02	6.10	0.63	6.60	5.97	....	6.46	4226
4225	The Rogers & Hubbard Co., Portland (In Fire)	Allied Tobacco Co., Hartford ..	0.04	0.05	6.85	15.70	8.85	....	13.68	4225
4275	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford ..	5.15	6.26	0.70	6.53	5.83	....	6.09	4275
4276	The Rogers & Hubbard Co., Portland	Allied Tobacco Co., Hartford ..	5.13	6.24	0.38	7.13	6.75	0.15	6.49	4276
4303	The Rogers & Hubbard Co., Portland	Tobacco Station, Windsor	4.99	6.07	0.78	5.40	4.62	....	3.89	4303
4305	The Rogers & Hubbard Co., Portland	Tobacco Station, *Windsor*	5.00	6.08	0.65	5.18	4.53	0.35	3.99	4305
4884	Woodruff's Fertilizer	Yale Athletic Association	2.03	2.47	0.70	7.30	6.60	....	0.45	4884
4885	Stump & Walters Fertilizer	Yale Athletic Association	4.78	5.81	0.15	12.90	12.75	....	0.29	4885
2682	....	E. N. Austin, Suffield	4.49	5.46	1.38	5.10	3.72	1.34	6.21	2682
4764	....	E. N. Austin, Suffield	5.79	7.04	0.60	3.63	3.03	2.27	11.59	4764
3796	....	Allan J. Bartlett, Greenwich ...	5.46	6.64	3.83	11.65	7.82	....	3.50	3796
3928	....	Daigle Bros., Marion	4.15	5.05	0.53	9.73	9.20	....	7.46	3928
3773	....	Frank Flannigan, Cheshire	3.67	4.46	....	8.83	....	....	5.78	3773

VII. MISCELLANEOUS FERTILIZERS, AMENDMENTS AND WASTE PRODUCTS.

WOOD ASHES.

Twenty samples of wood ashes were analyzed. With the exception of two samples, **2648** and **2744**, which were very inferior, probably leached ashes, all were of good quality. Excepting the two samples mentioned, water-soluble potash ranged from 4.53 per cent to 7.92 per cent and averaged 6.23 per cent. Phosphoric acid ranged from 1.33 per cent to 2.78 per cent. Wood ashes will usually contain 30 per cent or more of lime. The prevailing price has been $5.00 per unit of potash. Canada is practically the only source of the commercial wood ashes used in this State.

Analyses are given in Table XVI.

TABLE XVI. ANALYSES OF WOOD ASHES.

Station No.	Manufacturer or Dealer.	Submitted or Purchased by.	Phosphoric acid.	Water-soluble potash.
	Sampled by Purchaser:		%	%
3510	*John Joynt, Lucknow, Canada*	*The Allied Tobacco Co., Hartford*	....	*5.21*
2648	....	L. M. Chapman, Danbury	1.50	1.14
2744	....	L. M. Chapman, Danbury	1.33	0.92
4080	John Joynt, Lucknow, Canada	A. A. Clark, Windsor	1.90	4.94
2620	John Joynt, Lucknow, Canada	John M. Clark, Simsbury	2.56	5.21
3843	John Joynt, Lucknow, Canada	Hatheway & Steane, Inc., Hartford	2.23	5.41
3960	John Joynt, Lucknow, Canada	Hatheway & Steane, Inc., Hartford	2.48	7.09
4132	John Joynt, Lucknow, Canada	Hatheway & Steane, Inc., Hartford	2.78	6.92
4133	John Joynt, Lucknow, Canada	Hatheway & Steane, Inc., Hartford	2.05	6.57
4134	John Joynt, Lucknow, Canada	Hatheway & Steane, Inc., Hartford	2.10	6.30
4254	John Joynt, Lucknow, Canada	Hatheway & Steane, Inc., Hartford	1.88	6.25
4255	Olds & Whipple, Inc., Hartford	Max Lavitt, Ellington	2.20	6.90
4082	*John Joynt, Lucknow, Canada*	*Joseph Rostek, Jr., Melrose*	*1.63*	*6.20*
3668	....	A. N. Shepard & Son, Hartford..	2.26	6.33
3829	John Joynt, Lucknow, Canada	Steane, Hartman & Co., Hartford	1.88	6.32
3830	John Joynt, Lucknow, Canada	Steane, Hartman & Co., Hartford	2.13	6.96
4210	John Joynt, Lucknow, Canada	Steane, Hartman & Co., Hartford	2.05	7.68
3416	John Joynt, Lucknow, Canada	J. B. Stewart, Windsor	....	4.53
4075	John Joynt, Lucknow, Canada	L. Wetstone & Sons, Hartford ...	1.70	5.34
4076	John Joynt, Lucknow, Canada	L. Wetstone & Sons, Hartford ...	1.78	7.92

SHEEP MANURE, ETC.

Twelve samples of sheep and other farm manures were analyzed. There were no considerable deficiencies except in **3876** which contains about ¾ of one per cent less than the guaranteed amount of potash.

These materials will contain, on an average, about 130 lbs. of plant food per ton, but they have additional agricultural value as conditioners and as suitable culture media for the growth of soil bacteria.

Analyses are given in Table XVII.

LIME.

Sixteen samples of liming materials have been analyzed during the year for purchasers and others interested. Results are given in Table XVIII.

The following discussion on the use of lime for soil amendment purposes should be of interest and is contributed by the Department of Soil Research.

The Use of Lime in Adjusting the Soil Reaction.

M. F. Morgan, *Soil Investigator.*

Ever since the state was first settled a few farmers have given some attention to the problem of "sour soils," and some form of lime has occasionally been applied to certain fields; but the problem of soil acidity was not keenly felt as long as good yields of the standard crops, such as timothy, corn, tobacco and potatoes, could be obtained without the use of lime. Excellent growth of such crops have been produced with heavy applications of manure or commercial fertilizers alone.

In recent years there has been an awakened interest in the soil reaction and its proper adjustment. Alfalfa and other legumes have begun to receive more attention. Vegetable crops are becoming increasingly important. The nature of certain plant diseases, such as potato scab and the black root rot of tobacco, is now more accurately known. Under such conditions it becomes imperative that the farmer should have definite knowledge of the reaction of his soil and how it may best be corrected to meet the demands of the particular crops in which he is most interested.

The older ideas of determining whether a field is "sour" from its general appearance are mostly very poor "guess work." Pastures which produce practically nothing but moss, cinquefoil, everlasting, broomsedge or poverty grass are supposed to be too acid to grow anything else. When one fails to get a stand of

TABLE XVII. ANALYSES OF

Station No.	Manufacturer or Brand.	Place of Sampling.
	Sampled by Station:	
3874	Pulverized. American Agricultural Chemical Co., New York City ...	Bristol Grain & Supply Co., Bristol ....
4083	So. American. American Agricultural Chemical Co., New York City	American Agricultural Chemical Co., New Haven Sales Dept. ....
3879	Armour Fertilizer Works, New York	Charles Templeton, Waterbury
3876	Berkshire Fertilizer Co., Bridgeport	Factory ....
3913	Groz-It. Pacific Manure & Fertilizer Co., San Francisco, Cal.	Southington Lumber & Feed Co., Southington ....
3911	Premier Poultry Manure. Premier Poultry Manure Co., Chicago, Ill.	Lightbourn & Pond, New Haven ....
3912	Premier Sheep Manure. Premier Poultry Manure Co., Chicago, Ill.	Lightbourn & Pond, New Haven ....
3916	Wizard Brand Manure. Pulverized Manure Co., Chicago, Ill.	S. P. Strople, New Britain ..
3917	Wizard Brand Sheep Manure. Pulverized Manure Co., Chicago, Ill.	S. P. Strople, New Britain ..
3895	"Sheep's Head." Natural Guano Co., Aurora, Ill.	F. S. Blish Hardware Co., So. Manchester ....
	Sampled by Purchaser:	
2700	....	S. D. Woodruff & Sons, N. Y.
2735	American Agricultural Chemical Co., New York City	S. D. Woodruff & Sons, N. Y.

SHEEP MANURE, ETC.

Total nitrogen.	Ammonia equivalent to total nitrogen.		Phosphoric acid.				Potash.		Station No.
			Available.		Total.				
	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	
%	%	%	%	%	%	%	%	%	
1.54	1.87	1.75	....	....	0.88	0.75	1.95	2.00	3874
1.29	1.57	1.50	....	....	0.95	1.00	2.74	2.50	4083
1.57	1.91	1.50	....	....	1.55	1.00	3.39	2.00	3879
1.76	2.14	2.18	1.10	1.00	1.33	....	1.26	2.00	3876
1.57	1.91	1.82	0.80	0.75	0.90	1.25	2.85	3.00	3913
5.68	6.91	6.00	2.53	2.50	2.58	2.75	1.25	1.30	3911
1.88	2.29	2.43	0.75	1.00	0.83	1.20	2.40	2.00	3912
2.11	2.57	2.10	1.25	1.00	1.45	....	1.99	1.00	3916
2.03	2.47	2.43	1.57	1.25	1.65	....	3.40	2.00	3917
2.50	3.04	2.73	1.85	1.00	2.10	1.25	2.41	2.00	3895
1.57	1.91	....	....	....	0.63	....	2.96	....	2700
1.92	2.33	1.50	....	....	1.24	1.00	3.42	2.50	2735

grass, and red sorrel appears in the mowing lots, then the soil is thought to be "sour." Probably these diagnoses are correct, but they are not necessarily so. Many wet fields in limestone regions "look sour," but actually contain an abundance of lime. A serious phosphorus deficiency can produce the characteristic symptoms of acidity as shown by the character of pasture vegetation, and several pasture fertilization trials in this state have shown that in limed plots without other treatment the type of growth is unchanged. Sorrel thrives luxuriantly on a soil which has been heavily limed, if for any reason there is not a complete stand of grass or clover. A large number of soil tests by the Soils Department of this Station have shown that practically every field in the state is acid to some degree, unless it has been limed recently. Except for a few small areas in the western part of the state the rocks from which our soils are derived contain no lime carbonate, and even in these areas the limestone is so local in occurrence as to influence the soil to a very slight extent. Our common rocks, when weathered under conditions of normal rainfall, normally produce acid soils. The degree of acidity will be determined by the exact nature of the rock from which the soil is derived, the climate, the leachiness of the soil, the amount of organic matter and colloidal material (very fine particles) which the soil contains, and the agricultural practice followed on the field. All farmed soils of humid regions tend to become more and more acid, due to the constant removal of basic material through leaching and crops taken from the field.

The true measure of the degree of soil acidity is the concentration of the acid-reacting matter technically known as "hydrogen-ions." To express this in a simple way, scientists have devised the "pH" scale. On this basis, a neutral soil, neither acid or alkaline, has a reaction of 7 pH. (The figure 7 has a definite mathematical significance as related to the actual concentration of hydrogen-ions.) Below 7 pH indicates acidity, above 7 indicates alkaline conditions. As applied to Connecticut soils, the scale operates as follows:

Below 4 pH, extremely acid soils of rare occurrence.
4-5 pH—Very acid soils.
5-6 pH—Moderately acid soils, growing good crops of corn, timothy, tobacco, potatoes, etc., when other conditions of fertility are favorable, but too acid for alfalfa, beets, cabbage, onions, cauliflower, and other "acid-sensitive" crops.
6-7 pH—Slightly acid soils, favorable for growth of most crops.
7 pH—Neutral soils.
7-8 pH—Slightly alkaline soils, rare in this state unless heavily limed at a recent date.

Fortunately it is now possible by rapid field or laboratory tests to determine quite accurately the "pH" of a soil, so that the exact conditions of soil acidity may be known, and after taking into proper consideration the amount of organic matter, drainage conditions and fertilizer treatment, one can estimate fairly closely the need for lime of a particular crop on that soil.

It is not always necessary or desirable to lime a soil which has been found to be acid. Certain crops, such as strawberries, are not affected by soil acidity, while corn, potatoes and timothy do well on moderately acid soils (5-6 pH). Recent investigations have shown that the black root rot of tobacco is most prevalent on soils which are neutral or only slightly acid (5.9 to 7 pH). Potato scab is prevented by a moderate degree of acidity (below 5.6 pH). Lawn experiments at the Rhode Island Station have demonstrated that "weedless" lawns of the finest fine-leaved grasses are best secured on fairly acid soils. Soil acidity may be either injurious, of no consequence, or beneficial, depending upon what we wish to grow.

If it is necessary to make a soil less acid or correct the acidity entirely in order to produce certain crops, some form of lime-bearing material must be incorporated with the soil. In common practice, three liming materials are used: burnt lime ("stone lime" or "quick lime"), hydrated lime ("slaked lime") and ground limestone (lime carbonate).

The relationship between the chemically pure forms of the above materials is as follows: 100 lbs. of ground limestone = 74 lbs. of hydrated lime = 56 lbs. burnt lime. None of these materials are pure, and usually there is more or less of the corresponding forms of magnesium, similar in value to lime.

Commercial liming materials are judged on the basis of actual lime and magnesia (oxides of calcium and magnesium), which they contain, and upon their degree of fineness. The various products are quite variable in composition, but in general they will contain mixed oxides about as follows:

Material.	Oxide of Calcium and Magnesium. %
Limestone	45-55
Oyster shells	40-50
Burned lime	85-90
Hydrated lime, high grade	65-75
Hydrated lime, low grade, containing over 10% carbonates	55-60
Lime ashes	50-60

The rapidity of action of lime in the soil will depend upon its degree of fineness. It is necessary that the material shall be ground sufficiently fine to produce relatively quick effect without prohibitive cost of grinding. For average conditions, a medium

TABLE XVIII. ANALYSES OF

Manufacturer or Brand.	Sampled by.
Coe Lime Works, Northford.	
Ground Limestone	Sidney Edwards, Middletown ....
Conn. Agricultural Lime Co., New Haven.	
Hydrated Lyme No. 1	E. Mehmel & F. Sarvi, Plantsville ....
Hydrated Lime No. 2	E. Mehmel & F. Sarvi, Plantsville ....
Conn. Agstone Co., Danbury.	
Ground Limestone	Station agent from stock of L. B. Wooding, No Haven ....
Ground Limestone	Station agent from stock of Geo. S. Jennings, Sou port ....
Ground Limestone	Station agent from Factory ....
Ground Limestone	Comstock & Ferry, Wethersfield ....
Ground Limestone	S. Ellsworth Hall, East Wallingford ....
Ground Limestone	Station agent from stock of H. B. Brownson, Shel
Farnam Cheshire Lime Co., Farnams, Mass.	
Agricultural Lime	Amos D. Bridge's Sons, Hazardville ....
Grangers Mfg. Co., West Stockbridge, Mass.	
Ground Limestone	Chas. R. Treat, Orange ....
Ground Limestone	Chas. R. Treat, Orange ....
Ground Limestone	Station agent from stock of Edward Myers, Betha
International Agricultural Corp., Boston, Mass.	
Hydrated Lime	Benj. G. Southwick, Hartford ....
Hydrated Lime	Station agent from stock of Frank Flannigan, W Cheshire ....
Manufacturer Unknown.	
10274	A. N. Shepard & Son, Hartford ....

Limestone, Etc.

Chemical Analysis.						Mechanical Analysis.					
ne (CaO).		Magnesia (MgO).									
...	Guaranteed.	Found.	Guaranteed.	Total Oxides.	Insoluble in acid.	20 mesh.	40 mesh.	50 mesh.	80 mesh.	100 mesh.	Station No.
%	%	%	%	%	%	%	%	%	%	%	
12	....	0.78	....	50.90	8.10	84.00	66.00	55.00	46.00	42.00	**4427**
92	....	32.17	....	81.19	3.06	88.00	65.50	48.00	32.00	29.00	**4099**
63	....	3.77	....	71.40	2.62	93.00	70.00	49.00	30.00	24.00	**4100**
10	45.00	4.61	3.00	48.71	....	99.50	91.00	80.00	68.50	64.00	**3807**
04	45.00	5.50	3.00	48.54	11.70	99.50	91.00	83.50	74.00	69.00	**4117**
92	45.00	4.54	3.00	49.46	10.50	99.50	92.00	82.00	72.00	66.00	**4118**
76	....	5.91	....	50.67	10.14	99.50	92.00	83.00	71.00	66.50	**4273**
75	....	5.75	....	49.50	10.56	99.50	92.00	83.00	71.00	66.00	**4274**
32	45.00	3.86	3.00	49.18	11.39	99.00	91.00	81.00	70.50	67.50	**4666**
55	....	1.06	....	69.71	0.71	88.50	54.00	30.00	14.00	11.00	**4440**
50	....	1.02	....	52.52	....	99.80	99.50	97.50	84.00	77.00	**2797**
34	....	0.77	....	54.11	3.93	100.00	100.00	98.00	89.50	84.00	**4101**
14	35.00	6.92	1.00	49.06	10.80	96.50	83.00	70.00	55.00	50.00	**4277**
45	....	7.23	....	69.68	2.07	98.00	90.00	76.00	60.00	55.00	**4200**
38	....	33.10	....	81.98	0.96	84.00	55.50	42.50	31.50	29.00	**4455**
36	....	32.44	....	80.80	....	100.00	100.00	99.50	95.00	93.00	**3669**

ground lime or limestone seems to be the most desirable commercial product. A reliable authority states that pulverized limestone, all of which will pass a 10 mesh sieve, 70% of which will pass a 50 mesh sieve, and 50% of which will pass a 100 mesh sieve, should give excellent results, and yet be cheap enough to make its use worth while. In Ohio the standard required by law for agricultural ground limestone is that 95% of the material shall pass a 10 mesh screen, 50% shall pass a 50 mesh screen, and 30% shall pass a 100 mesh screen. If immediate results are desired in the use of a moderate amount of lime for a special crop of high money value, extreme fineness may be desirable, regardless of the greatly increased cost.

The exact amount of lime to be applied to properly adjust the soil reaction is not easily determined, even in the laboratory, and only general recommendations can be made. The following are safe quantities which should give good results on average Connecticut soils:

TONS LIMESTONE PER ACRES.

Crop.	Extreme Acidity.	Strong Acidity.	Moderate Acidity.	Slight Acidity.
Alfalfa	4–6	3–4	2–3	½–2
Asparagus	4–6	3–4	2–3	½–2
Barley	3–4	2–3	½–2	0
Beets	4–6	3–4	2–3	½–2
Cabbage	4–6	3–4	2–3	½–2
Carrots	3–4	2–3	½–2	0
Clover, red	3–4	2–3	½–2	0
Clover, alsike	2–3	½–2	0	0
Corn	2–3	½–2	0	0
Lettuce	4–6	3–4	2–3	½–2
Oats	2–3	½–2	0	0
Onions	4–6	3–4	2–3	½–2
Potatoes	1–2	½–1	0	0
Radishes	3–4	2–3	½–2	0
Red top	1–2	½–1	0	0
Rye	1–2	½–1	0	0
Spinach	4–6	3–4	2–3	½–2
Strawberries	0	0	0	0
Timothy	2–3	½–2	0	0
Tobacco	2–3	½–2	0	0

(Use other forms of lime in equivalent amounts.)

MISCELLANEOUS.

In this group are included thirteen samples of check fertilizers in the coöperative program of the Royster Guano Co., and thirty samples of check cottonseed meal in a similar program of the American Oil Chemists' Society.

Eighteen other samples of a miscellaneous character have been analyzed, making the total for this group sixty-one.

3996. *Four Seasons Fertilizer.* This product is apparently intended for greenhouse use although it is recommended for lawns, golf greens, etc. It consists largely or entirely of waste cacao material, chiefly cacao shells. It contains 2.3 per cent of nitrogen, all of which is organic and largely (1.9 per cent) insoluble in water; about 1 per cent of phosphoric acid; and 2.2 per cent of water-soluble potash. One ton of this material, therefore, contains about 110 lbs. of plant food, 46 lbs. of which is nitrogen, largely in insoluble and inactive forms. The use of this material as a conditioner or amendment might be justified if it could be obtained at reasonable cost.

2618, 2619. *Guano* from Hobbies Keys, off the Nicaragua coast. Submitted by C. L. Beach of Storrs.

Analyses:

	2618 Light.	2619 Dark.
Nitrogen	1.06%	2.40%
Available phosphoric acid	7.93	5.37
Total phosphoric acid	27.28	14.47
Total potash	0.07	0.12

At average commercial valuations of nitrogen and phosphoric acid the plant food in these materials is worth about $25.00 per ton. They are rather inferior as guanos, however, since they are poor in nitrogen, the element for which such materials are chiefly valuable. Guanos of fair quality will contain from 5 to 8 per cent of nitrogen while good guanos will contain 10 per cent, or over, of this constituent.

2636. *Rock Bone,* submitted by C. R. Burr and Co., Inc., Manchester.

This was rather coarse bone containing 1.53 per cent of nitrogen and 30.80 per cent of phosphoric acid.

3349. *Horn Shavings.* Griffin Button Co., Shelton. This waste material contains 14.59 per cent of nitrogen and a trace of phosphoric acid. The nitrogen is practically all insoluble but activity values by laboratory methods were high, 80 to 90 per cent. Some authorities regard horn as inferior because of its slow decomposition; others regard it as an effective fertilizer. On the basis of "activity" values for nitrogen by present methods it cannot be regarded as inferior.

3659. *Bone Meal* which had been used hardening steel. Submitted by E. W. Aspelin, Bristol. The nitrogen of the bone had been burned away but the material contained 21.12 per cent of phosphoric acid. It could be used as a source of phosphorus for fertilizer purposes.

3907. *Wool Waste.* Submitted by the Somersville Mfg. Co., Somersville. Material of this sort may contain considerable and varying amounts of nitrogen and small amounts of potash, usually from 1 to 3 per cent. This sample contained 14.59 per cent of nitrogen. The nitrogen is slowly available, however, and in the fertilizer industry such material is treated with sulphuric acid which makes the nitrogen more active. After this treatment it is suitable for mixing with other base goods in commercial fertilizer mixtures.

Wool waste has been used directly on the farm, spreading it broadcast and plowing under in preparation for seeding down. It can also be utilized in compost heaps mixed with wet stable manure.

3801, 3929. *Sewage Sludge.* **3802.** *Incinerator ashes.* Submitted by F. C. Oefinger, Stamford.

Analyses of materials as received:

	3801 %	3929 %	3802 %
Nitrogen	0.73	0.80	...
Phosphoric acid (total)	0.26	0.36	0.85
Potash (total)	0.07	0.07	0.27

Sample **3801**, as received, was about ⅔ water, so that 3 tons would yield about 1 ton of air-dry material and contain about 60 pounds of plant food. Sample **3929** was about ½ water, hence 2 tons would yield 1 ton of air-dry material and contain about 50 pounds of plant food.

In addition to the plant food contained in it such material has some value as a conditioner on light soils, but the cost of carting, drying, etc., is likely to exceed its agricultural worth.

The incinerator ashes are poor in fertilizer ingredients, the phosphoric acid and potash in them being worth less than a dollar per ton.

4185. *Tobacco Stems.* Tobacco By-Products and Chemical Corporation, Richmond, Va. Sampled by the station agent from stock of E. J. Bantle, Glastonbury.

Analysis:

Nitrogen in nitrates	0.29%
total	1.19
Phosphoric acid, total	0.60
Potash, total	4.78

3056. *"Black Tobacco"* and **3057** *Light Tobacco.* Submitted by Dr. P. J. Anderson, Tobacco Station, Windsor.

In the curing of tobacco "black" leaves sometimes occur which as compared with normal (light) leaves are of poor quality and of little commercial value.

Comparative analyses of "black" and light leaves are given in Table XIX.

The analyses were made partly because of the fact that some growers felt that the occurrence of black leaves was possibly due to the increased use of magnesia in their fertilizer materials. While the black leaves show about twice as much magnesia as the light leaves, there appears to be no special significance in this since old analyses show considerably larger amounts of this ingredient than was found in either of these samples.

2918. *Humus.* Submitted by H. S. Coe, Waterbury.

Analysis:

Water	19.38%
Ash (sand, etc.)	53.03
Organic and volatile	27.59
Nitrogen	1.46
Phosphoric acid	0.20
Potash soluble in water	0.73

This material would be useful as an absorbent but contains no considerable plant food other than about 1.5 per cent of nitrogen.

4765. *Apparently peat or muck.* Submitted by Geo. D. Shedd, Willimantic.

TABLE XIX. ANALYSES OF TOBACCO (LEAVES).[1]

	No. 3056 Black Tobacco.		No. 3057 Light Tobacco.	
	As rec'd.	Dry basis.	As rec'd.	Dry basis.
Moisture	21.09	0.00	21.10	0.00
Total Ash	*21.21*	*26.88*	*19.18*	*24.31*
Nitric Nitrogen	0.66	0.84	0.62	0.79
Ammonic Nitrogen	0.62	0.79	0.72	0.91
Total Nitrogen	3.39	4.30	3.77	4.78
Sand	1.28	1.62	1.05	1.33
Soluble Silica (SiO_2)	0.18	0.23	0.13	0.17
Ferric Oxide (Fe_2O_3)	0.27	0.34	0.23	0.30
Aluminum Oxide (Al_2O_3)	0.12	0.16	0.01	0.01
Mangano-Manganic Oxide (Mn_3O_4)	0.12	0.16	0.16	0.20
Calcium Oxide (CaO)	4.23	5.36	3.68	4.66
Magnesium Oxide (MgO)	1.96	2.49	0.94	1.19
Sodium Oxide (Na_2O)	0.07	0.10	0.10	0.13
Potassium Oxide (K_2O)	5.61	7.11	6.05	7.69
Sulphur (S)	1.01	1.28	1.07	1.36
Phosphorus Pentoxide (P_2O_5)	0.45	0.56	0.60	0.76
Chlorine	0.24	0.31	0.18	0.23

[1] Analyses by H. J. Fisher.

TABLE XIX. ANALYSES OF TOBACCO (LEAVES)—*Concluded.*
Ash constituents in percentages of the total (crude) ash.

	No. 3056	No. 3057
Sand	6.02	5.45
Silica (SiO_2)	0.86	0.70
Ferric Oxide (Fe_2O_3)	1.26	1.23
Aluminum Oxide (Al_2O_3)	0.60	0.04
Manganese Oxide (Mn_3O_4)	0.60	0.82
Calcium Oxide (CaO)	19.94	19.11
Magnesium Oxide (MgO)	9.26	4.88
Sodium Oxide (Na_2O)	0.37	0.53
Potassium Oxide (K_2O)	26.45	31.53
Sulphur (S)	4.76	5.58
Phosphorus Pentoxide (P_2O_5)	2.08	3.12
Chlorine (Cl)	1.15	0.94
Undetermined, chiefly Co_2	26.65[1]	26.07[1]

[1] Co_2 may be 20-25%.

The sample contained about 0.8 per cent of nitrogen and only traces of phosphoric acid and potash. It is worthless as a fertilizer so far as plant food is concerned.

2750. *Fertilizer.* Submitted by Walter T. Clark, County Agent, Norwich, *to be tested for borax. No borax was found.*

1752 and **4936** were two samples of soil thought to contain valuable metals. They were both mica.

THE EFFECT OF CHLORIDES UPON THE BURNING QUALITY OF TOBACCO.[1]

E. H. JENKINS, *Director Emeritus.*

Regarding the use of muriates (chlorides) as tobacco fertilizers the opinion and practice of New England tobacco growers developed probably in large measure from the account of the experiments of Nessler and others in Germany which was set forth by Prof. S. W. Johnson, then chemist of the Connecticut Board of Agriculture, in the report of the Board, 1872, p. 384. He concluded:

"It is a result of observation in our state as well as in Europe that the use of salt (muriates) increases the crop, but with detriment to its burning quality.

"We must in general avoid employing fertilizers which contain salt or other chlorine compounds in raising wrapping or smoking tobacco."

At the same time Johnson notes that chlorine is not the only cause of poor burn.

"*It is most probable that burning quality is the result of the coincidence of several conditions.*

[1] The renewed interest in the question of chlorides in fertilizer materials, and the proposed limitations for chlorine in raw materials and in mixed goods intended for use in tobacco culture, make this brief review by *Dr. Jenkins of particular interest.* (E. M. B.)

"Abundance of organic potash in the leaf (that is potash combined with organic acids), abundance of cellulose (woody fiber), abundance of sulphates,[1] are evidently favorable to easy burning On the other hand, sugar, gum (pectic acid) and albuminous matters are difficult of combustion. Mineral salts, which fuse at a burning temperature, chlorides and phosphates of potash and soda, hinder free burn."

Fermentation, which reduces the quantity of sugar and probably other ingredients, acts on the whole to improve burn. The results given in our Bulletin 180, however, prove that in no case was the fire-holding capacity of a poor burning sort made satisfactory by fermentation.

Garner observes that the compounds in the leaf which are of importance in producing a good burn are the potash salts of the organic acids such as malate and citrate, and these are only formed from the potash which remains over after the mineral radicals, such as chlorine and sulphuric acid, have been neutralized.

While the harmful effects of chlorine under certain conditions is everywhere admitted, the question has been raised whether the experiments made in other countries, on soils different from ours, with different strains of tobacco and under methods of growing and harvesting unlike our own, were strictly applicable to our conditions; and it has been asked what definite and careful tests have been made in this country which prove that muriates injure the burning quality of the leaf. It is worth while to consider the question and note the observations of different experimenters.

The Virginia Station[2] reports that experiments conducted since 1906 indicate that "The sulphate is preferable as a source of potash for flue-cured tobacco. . . . . Muriate and kainit contain chlorine; experiments have established the fact that chlorine tends to impair the burning quality of the leaf." Fifty to one hundred and fifty pounds of sulphate, i. e., 25 to 75 pounds of potash, are recommended. .

T. K. Wolfe, Professor of Agronomy, Virginia Polytechnic Institute, says:[3]

"Five years results with dark tobacco and two years results with light tobacco show that tobacco produced from the use of muriate was equal and usually superior to that produced from the use of sulphate of potash. The selling price of the muriate and sulphate tobacco was identical. From the standpoint of yield and selling price muriate of potash is to be preferred to sulphate especially since the former is cheaper. In tobacco, the burning quality has to be considered as well as the yield. Burning tests[4] conducted with tobacco from the

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[1] Further observation make more than questionable the value of "abundance of sulphates."

[2] Bull. 205, 1914.

[3] Tobacco, Vol. XLII, No. 1, p. 30, April 29, 1926.

[4] Tests made on rolled cigars.

Virginia Station showed that the sulphate of potash held fire for 3½ minutes while the muriate of potash held fire for 1¾ minutes or exactly one-half as long as the sulphate tobacco."

In the report of the North Carolina Station, 1919, p. 32, it is stated that while there is some evidence that muriate may give good results, from the standpoint of the grower its use is not advocated because without doubt it injures the burning quality. In the experiments as high as 160 pounds of potash were used but from 36 to 40 pounds pays best.

Practically the same is said in the North Carolina report for 1920, i. e., muriate in quantities up to 80 pounds per acre of potash gave larger yields but poorer quality.

In the report of the same Station, 1921, p. 30, larger yield from muriate is reported and market value the same as from tobacco grown on sulphate, but muriate does not improve the burning quality.

A letter from the chemist of a fertilizer company doing a large business in the southern tobacco regions says that the Virginia and North Carolina tobacco regions recommend a fertilizer supply of potash of one half muriate and one half sulphate of potash.

The Ohio Station[1] states, in experiments with tobacco grown alone or in rotation with other crops, but with the fertilizers applied on tobacco, covering six, five and four year periods, 60 pounds of muriate were applied per acre. When the amount of muriate was increased the yield was not increased and the quality was reduced.

These observations were made in regions where pipe and cigarette tobaccos are produced and where "burn" is not so vital a thing as with us where wrapper and binder leaf is the only kind grown at present.

With us in New England a good burn is about the first essential. The leaf must hold fire well, not burning too fast or too slowly. It must not coal on the cigar and it must leave a clear white or light gray—not "muddy"—ash. These requirements for the most part do not apply to other types of leaf. Moreover, the quantity of potash used at the south, 40 to 75 pounds to the acre, is much less than is used here, 150 to 200 pounds—which is perhaps in some cases excessive. Under our conditions, therefore, it is evident that the risk of damage in using muriate is very much greater than with other types of tobacco.

At the same time some growers have been unnecessarily anxious to exclude even quite small quantities from the fertilizer. It is certain that a certain small quantity is necessary to the normal development of the crop.

[1] Bull. 285, p. 210.

Dr. Garner[1] concludes from his laboratory tests that while chlorine is undoubtedly injurious the experiments indicate "that it requires larger quantities to seriously affect the burning quality than is commonly supposed."

Dr. Anderson of the Tobacco Sub-Station at Windsor kindly permits the following statement in advance of his printed report.

Plots under test, each made in triplicate, had identical applications of nitrogen and phosphoric acid. All received the same amount of actual potash, 172 pounds per acre, but in different forms. From each set of three, 160 burning tests[2] were made, after fermentation, with these results.

Tobacco fertilized with sulphate of potash burned	34.3 sec.
Tobacco fertilized with carbonate of potash burned	44.9 sec.
Tobacco fertilized with muriate of potash burned	4.8 sec.
Tobacco fertilized with 2/3 nitrate, 1/3 carbonate burned	43.1 sec.
Tobacco fertilized with ½ sulphate, ½ carbonate burned	38 sec.
Tobacco fertilized with 1/3 carbonate, 1/3 nitrate, 1/3 sulphate ..	43.5 sec.

Tobacco experts who examined the leaves also agreed that the chlorine (muriate) sample had bad burning quality and that all the others were good. Thus the evidence of experiment and observation of intelligent growers indicate that to use any considerable amount of muriate of potash in tobacco fertilizers is sure to damage or ruin its quality but no damage is likely to be done by the very small quantities of chlorine unavoidably present in commonly used fertilizer materials. The desire of some growers to exclude even these small quantities is not justified. Let it also be borne in mind that poor burn may also be caused by the accidents of the season and is not always to be ascribed to a fault in the fertilizer.

[1] Bull. 105, Bureau of Plant Industry.
[2] Tests made by ignition of single leaves with electric match.

BULLETIN 283 JANUARY, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

The Quality of Vegetable Seed Sold in Packets in Connecticut

In coöperation with
The Commissioner of Agriculture

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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:HE TUTTLE, MOREHOUSE & TAYLOR COMPANY

The Quality of Vegetable Seed Sold in Packets in Connecticut

By E. M. Stoddard and A. D. McDonnell.

Connecticut has no "pure seed law," but for many years the Experiment Station has made a practice of examining seed for germination and purity. The Report for 1877 contains a table giving the results on 33 samples of vegetable, grass and clover seed and from time to time the Reports of the Station have included the data on tests of seeds for a given year or a series of years. In fact, the Station was a pioneer in this field, having made in the early years a special study of methods and has always made seed tests for farmers and growers as a part of its educational and service work.

Citizens of the state may send samples for testing with the understanding that the results will be published but the number and distribution of such samples is not sufficient to furnish real information as to the quality of seed offered for sale on the open market. The quality of field and vegetable seeds has steadily risen as farmers have learned to demand better seeds, but there is occasionally a suggestion that some seed, especially that sold in small packets, is not as good as it should be. With the purpose of examining such seed and determining its quality this study was made.

The seed was purchased in sealed packets at retail prices ranging from 5 cents to 20 cents each. The tests made were for germination only, there being no consideration given to the purity of the sample; to the size of the packets; to the weight of the seed; to its freedom from disease; or to any other point.

The standard methods of procedure were followed in making the tests. In brief, 200 seeds were selected from each sample to be germinated. These seeds were put in a standard germinating chamber in duplicate lots of 100 seeds each, the smaller seeds being placed on a substratum of blotting paper, and the larger seed such as corn, peas, and beans, on flannel cloth. The substratum was kept moist by daily applications of unsterilized water. Each sample of seed was kept in the germinating chamber for the standard number of days required to germinate such seed. In no case was any sample allowed any special consideration.

SEASON OF 1925.

In 1925, the Station agent purchased in the course of his sampling trips 57 samples representing the stock of 14 growers or distributors. These were tested for germination and the results are given in Table I.

TABLE I. SEED GERMINATION TESTS OF 1925.

Test Number	Grower or Distributor; and Variety of Seed	Sold by	Per cent of
	F. T. Bliss Hardware Co., South Manchester.		
447	Carrot, Danvers Half Long	F. T. Bliss Hardware Co.,	[illegible]
446	Lettuce, Hartford Bronze Head	South Manchester.	[illegible]
445	Spinach, Long Standing	" " " "	[illegible]
	W. A. Burpee & Co., Philadelphia, Penn.		
470	Carrot, Long Orange	Harrison & Gould, Milford.	[illegible]
472	Lettuce, Big Boston	" " "	[illegible]
471	Onion, Yellow Globe	" " "	[illegible]
	Clapp & Treat, Hartford, Conn.		
2465	Cucumber, White Spine	S. P. Strople, New Britain.	[illegible]
2464	Lettuce, Big Boston	" " " "	
2466	Onion, Danvers Yellow Flat	" " " "	
	D. M. Ferry, Detroit, Mich.		
2435	Carrot, Imp. Long Orange	F. B. Newton, Plainville.	
2437	Corn, Early Sweet	" " "	
2433	Lettuce, Simpson's Early Curled	" " "	
2436	Onion, Imp. Yellow Globe	" " "	
2438	Peas, Nott's Excelsior	" " "	
2434	Spinach, Thick Leaf Round Seeded	" " "	
	Chas. C. Hart Seed Co., Wethersfield, Conn.		
2422	Carrot, Danvers Half Long Stump Root	G. W. Thorpe, West Cheshire.	
2420	Corn, Hart's Early Dawn	" " " "	
2421	Peas, Nott's Excelsior Early Dwarf	" " " "	
2454	Lettuce, Big Boston	Bacon Bros., Middletown.	
2456	Onion, Red Wethersfield	" " "	
	Lake Shore Seed Co., Buffalo, N. Y.		
2475	Corn, Ea. Minnesota	Collins & Freeman, Branford.	
2473	Lettuce, Salamander	" " "	
2476	Onion, Southport Yellow Globe	" " "	
2474	Spinach, Round Leaf	" " "	
	D. Landreth Seed Co., Bristol, Penn.		
2469	Carrot, Danvers Half Long	Stillman Hardware Co.,	
2468	Lettuce, Salamander	New Canaan.	
2467	Onion, Sport Red Globe	" " "	
	Lyman Seed Co., Springfield, Mass.		
2453	Cucumber, White Spine	Bacon Bros., Middletown.	
2455	Spinach, Thick Leaf	" " "	

TABLE I. SEED GERMINATION TESTS OF 1925—*Concluded.*

Test Number	Grower or Distributor; and Variety of Seed	Sold by	Per cent of
	New Britain Seed Store, New Britain, Conn.		
457	Carrot, Danvers Half Long	S. P. Strople, New Britain.	74
459	Lettuce, Big Boston	" " " "	84
458	Onion, Red Wethersfield	" " " "	57
	Northrup-King Co., Minneapolis, Minn.		
426	Beet, Early Blood Turnip	F. W. Woolworth Co.,	78
423	Carrot, Imp. Danvers Half Long	Winsted.	84
424	Lettuce, Grand Rapids	" " "	51
425	Lettuce, Round Thick Leaf	" " "	80
427	Onion, Large Wethersfield	" " "	87
428	Peas, American Wonder	" " "	95
	Olds & Whipple, Hartford, Conn.		
461	Cucumber, Boston Pickling	S. P. Strople, New Britain.	93
460	Lettuce, Early Curled Silesia	" " " "	74
462	Onion, Southport Red Globe	" " " "	94
463	Spinach, Long Standing	" " " "	73
	Page Seed Co., Greene, N. Y.		
448	Carrot, Chantenay	R. W. Hine, Cheshire.	76
451	Corn, Stowell's Evergreen	" " "	86
449	Lettuce, Grand Rapids	" " "	91
450	Onion, Wethersfield	" " "	83
452	Spinach, Thick Leaved	" " "	61
	J. B. Rice Seed Co., Cambridge, N. Y.		
442	Carrot, Danvers Half Long	Bristol Grain Co., Bristol.	73
444	Corn, Country Gentleman	" " " "	72
440	Lettuce, Big Boston	" " " "	81
441	Onion, Wethersfield Large Red	" " " "	83
439	Peas, Premium Gem Dwarf	" " " "	89
443	Spinach, Bloomsdale Savoy	" " " "	78
	Ross Bros. Co., Worcester, Mass.		
432	Beet, Crosby's Egyptian	W. R. Bosworth, Woodstock.	80
430	Carrot, Danvers Half Long	" " "	77
431	Lettuce, Big Boston	" " "	81
429	Onion, Yellow Globe Danvers	" " "	90

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SEASON OF 1926.

The inspection of 1925 showed some differences in quality but in our opinion did not include a sufficient number of samples to warrant publication. In order to secure this more complete sampling the coöperation of the Commissioner of Agriculture, Honorable Philo T. Platt, was solicited and readily granted. Through the efforts of the staff of the Market Reporting Service of the State Department of Agriculture it was possible to obtain 238 samples, representing 10 growers or distributors. These were all "packet seeds" purchased in the open market by the market reporters and paid for by the Station. The results of the germination tests are given in Table II.

TABLE II. SEED GERMINATION TESTS OF 1926.

Number	Grower or Distributor; and Variety of Seed	Sold by	Per cent of Germination
	The American Seed Co., Detroit, Mich.		
45	Beans, Dwarf Golden Wax	S. S. Kresge Co., Danbury.	82.
46	" Kentucky Wonder	" " " "	56.
54	Beet, Early Egyptian Blood Turnip	" " " "	60.
55	" " Blood Turnip	" " " "	66.
40	Carrot, Oxheart	" " " "	40.
41	" Danvers Half Long	" " " "	31.
51	Corn, Country Gentleman	" " " "	63.
42	Cucumber, Early White Spine	" " " "	87.
54	" Boston Pickling	" " " "	95.
56	Lettuce, Early Prize Head	" " " "	61.
57	" Butter	" " " "	31.
58	" Grand Rapids	" " " "	91.
44	Peas, Extra Early	" " " "	83.
43	Radish, Early Long Scarlet	" " " "	41.
52	" Short Top Early Scarlet Turnip	" " " "	75.
53	" Early Scarlet Globe	" " " "	73.
39	Squash, Early Summer Crookneck	" " " "	*
59	"	" " " "	58.
50	Spinach, Improved Thick Leaved	" " " "	*
33	" " " "	" " " "	25.
	W. Atlee Burpee & Co., Philadelphia, Penn.		
7	Beans, Bountiful	Jackson-Marvin Hdw. Co., Westville.	94.
8	" Burgess Stringless Green Pod		98.
9	" White Wax Bush	" " " "	97.
0	" Brittlewax	" " " "	97.
8	Beet, Black Red Ball	" " " "	88.
9	" Columbia	" " " "	*
0	" Detroit Dark Red	" " " "	78.
1	" Burpee's Improved Blood Turnip	" " " "	83.5
3	Carrot, Chantenay	" " " "	48.
4	" *Danvers Half Long Orange*	" " " "	62.
5	" Oxheart	" " " "	74.5
6	" Burpee's Improved Long Orange	" " " "	71.
4	Cucumber, Fordhook	" " " "	97.5
5	" Burpee's Fordhook Famous	" " " "	98.5
6	" Fordhook Pickling	" " " "	55.5
7	" Green Prolific	" " " "	93.5
2	Lettuce, Big Boston	" " " "	97.5
3	" May King	" " " "	98.0
4	" Iceberg	" " " "	96.5
5	" Wonderful	" " " "	93.5
0	Radish, New White Icicle	" " " "	72.0
1	" Burpee's Earliest	" " " "	76.5
2	" " Rapid Red	" " " "	77.5
3	" Scarlet Globe	" " " "	95.0
7	Spinach, Henderson's Long Green	" " " "	51.0
8	" Burpee's Victoria	" " " "	38.5

TABLE II. SEED GERMINATION TESTS OF 1926—*Continued.*

Test Number	Grower or Distributor; and Variety of Seed	Sold by	P
	W. Atlee Burpee & Co., Philadelphia, Penn.—*Cont.*		
2979	Spinach, Norfolk Savoy-leaved	Jackson-Marvin Hdw. Co.,	4
3006	“ Burpee's Princess Juliana	Westville.	8
	Clapp & Treat, Inc., Hartford, Conn.		
2961	Beans, Golden Wax	Clapp & Treat, Inc., Hartford.	9
2962	“ Six Weeks	“ “ “ “	9
2969	Beet, Eclipse	“ “ “ “	7
2970	“ Early Blood Turnip	“ “ “ “	8
2971	“ Crosby's Egyptian	“ “ “ “	7
2972	“ Bassano	“ “ “ “	8
2959	Carrot, Improved Long Orange	“ “ “ “	*
2960	“ Danvers Half Long	“ “ “ “	6
2951	Cucumber, Improved White Spine	“ “ “ “	8
2952	“ Green Cluster	“ “ “ “	9
2953	“ Early Frame	“ “ “ “	8
2954	“ Improved Long Green	“ “ “ “	8
2965	Lettuce, Hartford Bronze Head	“ “ “ “	[illegible]
2966	“ Cos Trianon	“ “ “ “	*
2967	“ Simpson's Early Curled	“ “ “ “	9
2968	“ May King	“ “ “ “	1
2955	Radish, Early Scarlet Turnip	“ “ “ “	7
2956	“ French Breakfast	“ “ “ “	8
2957	“ Icicle	“ “ “ “	6
2958	“ Round Black Spanish	“ “ “ “	8
2947	Spinach, New Zealand	“ “ “ “	7
2948	“ Thick Leaved	“ “ “ “	*
2949	“ Long Standing	“ “ “ “	*
2950	“ Round	“ “ “ “	8
	D. M. Ferry & Co., Detroit, Mich.		
3029	Beans, Golden Wax Bush	A. H. Watt, Redding Ridge.	78
3030	“ Dwarf Unrivalled Wax Bush	“ “ “ “	97
3055	Beet, Early Blood Turnip	“ “ “ “	61
3056	“ Detroit Dark Red	“ “ “ “	6
3057	“ Crosby's Egyptian	“ “ “ “	66
3054	Cabbage, Mammoth Rock Red	“ “ “ “	68
3034	Carrot, Early Scarlet Horn	“ “ “ “	58
3035	“ Chantenay	“ “ “ “	70
3036	“ Half Long Scarlet	“ “ “ “	54
3037	“ Danvers	“ “ “ “	57
3044	Cucumber, Boston Pickling	“ “ “ “	46
3045	“ Improved Long Green	“ “ “ “	47
3046	“ Early White Spine	“ “ “ “	84
3047	“ “ Short Green	“ “ “ “	68
3038	Lettuce, Mammoth Black Seeded Butter	“ “ “ “	80
3039	“ Ferry's Early Prize Head	“ “ “ “	90
3041	“ California Cream Butter	“ “ “ “	86
3042	“ May King	“ “ “ “	90

TABLE II. SEED GERMINATION TESTS OF 1926—*Continued.*

Grower or Distributor; and Variety of Seed	Sold by	Per cent of Germination
D. M. Ferry & Co., Detroit, Mich.—*Cont.*		
Lettuce, Big Boston	A. H. Watt, Redding Ridge.	94.5
" Black Seeded Simpson	" " " "	97.5
Radish, Icicle	" " " "	88.5
" Early Scarlet Turnip White Tip	" " " "	86.5
" " " "	" " " "	87.0
" French Breakfast	" " " "	85.5
" Improved Chartier	" " " "	84.5
Spinach, Long Standing Prickly Seeded	" " " "	63.5
" New Zealand	" " " "	3.0
" Thick Leaved Round	" " " "	68.0
Squash, Summer Crookneck	" " " "	62.0
The Chas. C. Hart Seed Co., Wethersfield, Conn.		
Beet, Early Dewing's Blood Turnip	H. E. Meekers, Danbury.	73.0
" Detroit Dark Red	" " "	89.5
Carrot, Danvers Half Long	" " "	60.5
Cucumber, Improved White Spine	" " "	82.0
" Boston Pickling	" " "	70.5
" Davis Perfect	" " "	76.0
Lettuce, Early Prize Head	" " "	97.5
" Simpson's Early Curled	" " "	77.0
" Big Boston Head	" " "	93.0
Parsnip, Long Smooth Sugar	" " "	48.0
Radish, Early Round Scarlet	" " "	83.5
Sage	" " "	84.0
Squash, Giant Summer Crookneck	" " "	85.5
Spinach, Early Giant Thick Leaf	" " "	76.0
Lake Shore Seed Co., Dunkirk, N. Y.		
Beans, Henderson's Bush Lima	W. E. Daley, Bethel.	79.0
" Red Valentine	" " "	33.0
Beet, Dewing's Improved Blood	" " "	67.0
" Detroit Dark Red	" " "	56.0
Carrot, Oxheart	" " "	16.5
" Danvers	" " "	67.0
Corn, Stowell's Evergreen	" " "	62.0
" Golden Bantam	" " "	77.0
Cucumber, Peerless White Spine	" " "	86.5
" Improved Long Green	" " "	43.5
" Boston Pickling	" " "	61.5
Lettuce, Prize Head	" " "	0
" Cos	" " "	42.5
" Wilson's Early Cabbage	" " "	0
Radish, Early Red Turnip	" " "	37.5
" Assorted	" " "	22.0
Squash, Golden Summer Crookneck	" " "	26.5
Spinach, Round Leaf	" " "	57.5

TABLE II. SEED GERMINATION TESTS OF 1926—*Continued.*

Test Number	Grower or Distributor; and Variety of Seed	Sold by	Per cent of
	Northrup-King Co., Minneapolis, Minn.		
2834	Beans, Kentucky Wonder Pole	F. W. Woolworth Co., Hartford.	82
2835	" Early Dwarf Black Wax		93
2852	Beet, Edmund's Improved Blood Turnip	" " "	95
2853	"	" " "	86
2826	Carrot, Chantenay	" " "	62
2827	" "	" " "	59
2828	" Oxheart	" " "	73
2829	Cucumber, Improved White Spine	" " "	89
2830	" Long Green	" " "	79
2836	" Chicago Pickling	" " "	98
2847	Lettuce, Grand Rapids	" " "	98
2848	" Black Seeded Simpson	" " "	100
2849	" Improved Hanson Head	" " "	92
2823	Radish, Early Scarlet Turnip	" " "	90
2824	" French Breakfast	" " "	98
2825	" Sterling White Tip	" " "	96
2831	Spinach, Round Thick Leaved	" " "	*
2837	Squash, Golden Summer Crookneck	" " "	94
2832	Sweet Corn, Peep o' Day	" " "	90
2833	" " Golden Bantam	" " "	90
	Olds & Whipple, Inc., Hartford, Conn.		
2887	Beans, Burpee's Stringless	Olds & Whipple, Inc., Hartford.	97
2888	" Golden Wax		97
2905	Beet, Dewing's Blood	" " "	71
2906	" Crosby's Egyptian	" " "	76
2907	" Detroit Dark Red	" " "	70
2908	" Swiss Chard	" " "	82
2872	Carrot, Early Half Long Scarlet	" " "	55
2873	" Danvers Half Long	" " "	65
2886	" Early Half Long Scarlet	" " "	54
2882	Cucumber, London Long Green	" " "	86
2883	" Davis Perfect	" " "	86
2884	" White Spine	" " "	96
2885	" Boston Pickling	" " "	94
2874	Lettuce, New York	" " "	100
2878	" Crisp-as-ice	" " "	91
2879	" Early Curled Silesia	" " "	97
2880	" Hanson Head	" " "	*
2881	" Tom Hannock	" " "	98
2865	Radish, Early Scarlet Turnip	" " "	69
2866	" French Breakfast	" " "	52
2867	" Early Scarlet White Tip	" " "	59
2870	" " Long Scarlet	" " "	76
2868	Spinach, New Zealand	" " "	52
2869	" Large Viroflay	" " "	78
2871	" Round Thick Leaf	" " "	68

TABLE II. SEED GERMINATION TESTS OF 1926—*Concluded.*

Grower or Distributor; and Variety of Seed	Sold by	Per cent of Germination
The Page Seed Co., Greene, N. Y.		
Beans, Page's Golden	H. E. Meekers, Danbury.	86.0
" Davis White	" " "	86.0
Beet, Crosby's Egyptian	" " "	66.5
" Detroit Dark Red	" " "	75.0
" Early Blood Turnip	" " "	83.0
Carrot, Oxheart	" " "	52.5
" Improved Long Orange	" " "	54.5
" Danvers Half Long	" " "	41.0
Corn, Golden Bantam	" " "	83.5
" Stowell's Evergreen	" " "	72.0
" Early White Cory	" " "	91.0
Cucumber, Long Green	" " "	82.5
" Early White Spine	" " "	95.0
" Paris Evergreen	" " "	90.5
Lettuce, Grand Rapids	" " "	74.0
" Early Prize Head	" " "	95.0
Radish, French Breakfast	" " "	83.5
" Early Scarlet White Tip	" " "	96.0
Squash, Summer Crookneck	" " "	70.0
Spinach, Bloomsdale	" " "	56.5
" Thick Leaved	" " "	*
The Rice Seed Co., Cambridge, N. Y.		
Beans, Dwarf Rust-proof Golden Wax	H. E. Meekers, Danbury.	87.0
" *Black Butter*	" " "	93.0
Beet, New Dark Red Eclipse	" " "	76.5
" Dewing's Early Blood Turnip	" " "	58.0
" Long Smooth Dark Blood	" " "	62.0
Carrot, True Danvers Half Long	" " "	52.0
" Early French Short Horn	" " "	45.0
" Rice's Improved Long Orange	" " "	*
Corn, Golden Bantam	" " "	*
" Crosby's Early	" " "	63.0
Cucumber, Improved Long Green	" " "	*
" " Early White Spine	" " "	91.0
" Extra Early Green Prolific	" " "	50.5
Lettuce, Early Curled Silesia	" " "	78.5
" Black Seeded Simpson	" " "	91.5
Radish, True French Breakfast	" " "	70.5
" Extra Early Scarlet Turnip	" " "	67.5
" Early Scarlet Turnip White Tip	" " "	82.0
Squash, Giant Early Summer Crookneck	" " "	79.0

NOTE: This sample showed a variance of 10% or more between the duplicate tests. insufficient quantity of seed on hand prevented retesting of the sample.

GERMINATION STANDARDS FOR VEGETABLES.

In the absence of official standards of germination for vegetable seed we present in Table III a standard of comparison for this particular study. These standards were obtained by plotting a frequency curve of tests made in our laboratory for a period of ten years of the several seeds, and taking the classes between which the largest number of units occurred as the standard. This method may be somewhat inaccurate, especially where only a few samples are taken, but it at least gives a good indication of what good seed should germinate under favorable conditions. The following chart of onion seed illustrates the method described above.

RESULTS OF GERMINATION TESTS OF 779 SAMPLES OF ONION SEED

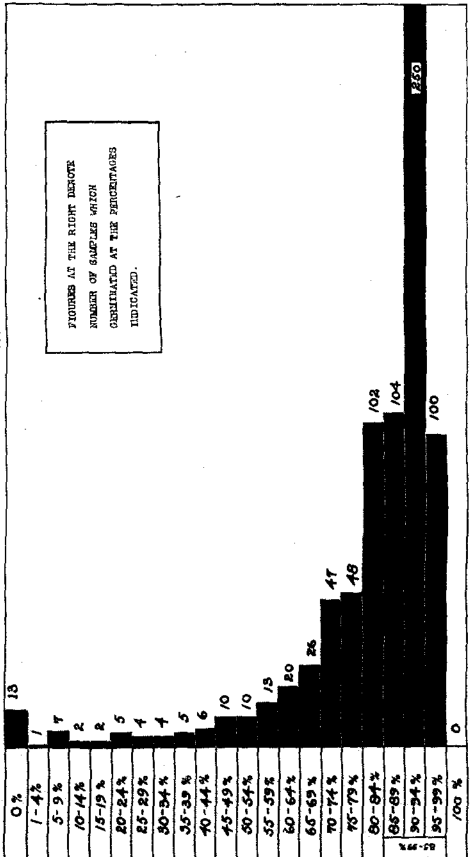

TABLE III. TABLE OF GERMINATION STANDARDS ADOPTED FOR COMPARATIVE PURPOSES.

Kind of Seed	Germination Standard	Number of Tests Used to Obtain Data
Beans	90 to 100%	145
Beet	85 " 100%	99
Cabbage	85 " 100%	32
Carrot	70 " 80%	59
Sweet Corn	90 " 100%	75
Cucumber	85 " 100%	69
Lettuce	80 " 95%	94
Onion	85 " 99%	779
Parsnip	40 " 50%	11
Peas	90 " 100%	167
Radish	85 " 100%	160
Squash	85 " 95%	29
Spinach	70 " 85%	135

NOTE: The germination of beet seed was determined by counts of the number of seed balls germinating and not by number of sprouts. No standards were set for New Zealand Spinach, because it is frequently very difficult to make the seed germinate in a germinator while the same seed may grow very well when planted under outdoor conditions. It may be noted from the germination tables that there is a wide variation in the results on this seed.

Judging the germination of the seed shown in Tables I and II by these standards, we find the following conditions:

Seed	Per cent of Samples above Standard 1925	1926
Beans	..	55
Beet	0	12
Carrot	100	16
Corn	60	[illegible]

BULLETIN 284 JANUARY, 1927

Connecticut Agricultural Experiment Station

New Haven, Connecticut

INDEX

TO REPORTS ON

FOOD PRODUCTS AND DRUGS

1915-1925

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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as of

January, 1927

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THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

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TO THE REPORTS OF THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

ON

FOOD PRODUCTS AND DRUGS 1915—1925

E. M. Bailey

INTRODUCTION

Examination of foods was begun by the Station as early as 1882, and was carried on under the provisions of special statutes which regulated the sale of milk, butter, vinegar and molasses, but not until 1896, under the general food law of 1895, was a separate report upon food products issued by the Station. With the passage of the Federal Food and Drugs Act in 1906 the Connecticut law was revised to include the inspection of drugs, and the annual report of 1908 contains the first account of systematic drug examination in this State.

From 1896 to 1925 inclusive some 52,000 samples of food products and drugs have been examined and reported upon. Bulletin 187, issued in June 1915, is an index to the food and drug reports of the Station from 1896 to 1914 inclusive. The present index covers the period 1915 to 1925 inclusive and represents the examination of about 23,000 samples.

The data contained in this long series of reports and bulletins is not entirely routine in character but include a considerable amount of investigational work. These two indices provide a key to this work as well as to the routine examinations made for the more immediate purpose of food and drug control.

In general, the plan and arrangement of the earlier index has been followed. The brand names of the more common foods and drugs may not always be found; but distinctive products are listed under their special names.

In the preparation of this index acknowledgment is particularly due to Richard T. Merwin and Gladys M. Finley, formerly

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BULLETIN 285 FEBRUARY, 1927

Connecticut Agricultural Experiment Station

New Haven, Connecticut

TWENTY-SIXTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

1926

W. E. BRITTON, Ph.D.
State Entomologist

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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as of

February 1927

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Soil Research.	M. F. Morgan, M.S., *Investigator.* H. G. M. Jacobson, M.S., *Assistant.*
Tobacco Sub-station [illegible]	Paul J. Anderson, Ph.D., *Pathologist in Charge.* [illegible]on, Ph.D., *Assistant Physiologist.*

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AUTHORSHIP

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ILLUSTRATIONS

The illustrations in this Report (Bulletin 285) are from the following sources: Figs. 1, 3, 5, and 8, outline maps shaded by B. H. Walden; Fig. 7 drawn by J. P. Johnson; Fig. 10 drawn by R. C. Botsford; Fig. 2 after *Federal Horticultural Board; Figs. 4, 6, 9, and 11, drawn by Dr. Philip* Garman. Plates are all from photographs; XII, b and c, XIII, b and c, after U. S. Bureau of Entomology; XV, by R. C. Botsford; II, VII, a, XI, a, and XIV, b, by W. E. Britton; IV, by R. B. Friend; VIII, b, by *J. P. Johnson; all others by B. H. Walden.*

BULLETIN 285

TWENTY-SIXTH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I have the honor to transmit herewith my twenty-sixth annual report as State Entomologist of Connecticut. As usual, this report gives a full account of the activities of the Department of Entomology, particularly the inspection and control work prescribed by Statute, and also the various lines of research and observation dealing with economic insects, which have engaged the attention of the members of the Department staff during the year.

Respectfully submitted,

W. E. Britton,

State and Station Entomologist.

SUMMARY OF INSPECTION AND OFFICE WORK

230 samples of insects received for identification.
182 nurseries inspected.
174 regular certificates granted.
3 special raspberry certificates granted.
94 nursery dealers' permits issued.
181 shippers' permits issued to nurserymen in other states.
202 duplicate certificates furnished to be filed in other states.
121 parcels of nursery stock inspected and certified.
565 bales of mountain laurel and other decorative material inspected and certified for shipment.
25,000 narcissus bulbs inspected and certified.
45 orchards and gardens examined.
32 shipments, containing 347 cases, 3,443,357 plants, imported nursery stock inspected.
13 shipments, or 40.6 per cent, found infested with insects or fungi.
814 apiaries, containing 7,923 colonies, inspected.
26 apiaries and 68 colonies found infested with European foul brood.
14 apiaries and 23 colonies found infested with American foul brood.
3,143 letters written on official work.
915 circular letters.
418 post cards.
58 reports to Federal Horticultural Board.
3,262 bulletins, etc., mailed on request or to answer inquiries.
67 packages sent by mail and express.
26 lectures and addresses at institutes, granges, and other meetings.

PUBLICATIONS OF THE ENTOMOLOGICAL DEPARTMENT, 1926

By W. E. Britton:

Twenty-fifth Report of the State Entomologist of Connecticut (Bulletin 275), 120 pages, 13 figures, 20 plates; 10,500 copies distributed in April.
Inspection of Nurseries in 1925, 16 pages, 3 figures; reprinted from the Report; 300 copies, April.
A New Pest of Lawns, Bulletin of Immediate Information No. 52, December 15, 1925; 4 pages, 1 figure; 3,250 copies, sent in March to all families in region infested.
Asiatic Beetle Quarantine, Bulletin of Immediate Information No. 53, 2 pages; 1,500 copies, April.
Borers in Relation to Cavities in Trees, *Tree Talk*, Spring Number, 2½ pages, 2 figures, March.
Red Mite and Railroad Worm, Report of Thirty-second Annual Meeting of the Massachusetts Fruit Growers' Association, Inc., page 175, 6 pages, May, 1926.
Report of Committee on Injurious Insects, Proceedings of the Thirty-fifth Annual Meeting, Connecticut Pomological Society, page 38, 5 pages, April.
Insects Attacking Vegetable Crops in Connecticut in 1925, Report of Connecticut Vegetable Growers' Association for 1925, page 13, 7 pages, August.
Three Injurious Insects Recently Introduced into Connecticut, *Journal of Economic Entomology*, Vol. 19, page 540, 5 pages, June.
Some Insects and Entomologists, Fifty-sixth Annual Report of the Entomological Society of Ontario, page 55, 8½ pages, September.
The Gipsy Moth Quarantine, Bulletin of Immediate Information No. 54, 5 pages, 1 figure, 3,225 copies, October.
General Index to the Reports of the State Entomologist (Bulletin 281), 53 pages; 3,775 copies, October.

By W. E. Britton and G. P. Clinton:

Spray Bulletin (271), 50 pages, 104 figures, January.

By W. E. Britton and P. J. Anderson:

Tobacco Insects Observed in Connecticut in 1925 (Tobacco Station Bulletin 6), page 74, 20 pages, 16 figures, March.

By Philip Garman:

The Oriental Peach Moth Problem in Connecticut, Proceedings Thirty-fifth Annual Meeting, Connecticut Pomological Society, page 44, 3 pages, April.

By R. E. Andrew and Philip Garman:

A Chemical Investigation of Some Standard Spray Mixtures (Bulletin 278), 20 pages, July.
Effect of the Order of Mixing Various Spray Ingredients on the Formation of Injurious Compounds, *Journal of Economic Entomology*, Vol. 19, page 671, 1 page, August.

By R. C. Botsford:

Progress of Mosquito Control Work in Connecticut during the Past Year, Proceedings Thirteenth Annual Meeting, New Jersey Mosquito Extermination Association, page 85, 2 pages, 1926.

INSECT PEST ACCOUNT

Report of Receipts and Expenditures of the State Entomologist

From July 1, 1925, to June 30, 1926

Receipts

Insect Pest Appropriation (biennial)	$35,000.00
" " " additions (miscellaneous receipts)	40.18*
	$35,040.18

Expenditures

Salaries	$14,010.50	
Labor	3,711.30	
Stationery and Office Supplies	73.88	
Scientific apparatus (Chemicals)	35.54	
" " (Other laboratory supplies)	62.59	
" " (Photographic)	30.48	
Lumber and small hardware	8.55	
Miscellaneous supplies	203.64	
Fuel oil	1,700.47†	
Automobile oil	5.85	
Telegraph and Telephone	16.46	
Postage	74.55	
Travel (Outlying investigations)	437.90	
" (Meetings, Conferences, etc.)	166.49	
" (Gasoline for automobiles)	186.01	
Freight, Express and Parcel Post	53.44	
Furniture and Fixtures (New)	8.58	
" " " (Repairs)	....	
Library (Books and Periodicals)	38.23	
Scientific Equipment (New)	57.40	
Tools, Machinery and Appliances (New)	219.98	
" " " " (Repairs)	4.51	
Automobiles (Repairs)	390.83	
New Buildings and Structures	337.05	
Rent of Land	66.66	
Insurance (Automobile)	172.07	
Miscellaneous Contingent Expenses	35.15	
Total		$22,108.11
Balance		12,932.07
		$35,040.18

* Use of automobiles at 6 cents per mile $31.98
Sale of honey 8.20
$40.18

† For burning around European Corn Borer infestations.

DEPARTMENT STAFF AND WORK

W. E. Britton, Ph.D., *State and Station Entomologist.*
B. H. Walden, B.Agr., *Photographic and General Work* } *Assistant Entomologists.*
M. P. Zappe, B.S., *Inspection and General Work*
Philip Garman, Ph.D., *Research Work*
Roger B. Friend, B.Sc., *Graduate Research Assistant.*
J. Peter Johnson, B.S., *Deputy in Charge of Asiatic Beetle Quarantine and Soil Treatment Work.*
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
James A. McEvoy, *Assistant in Gipsy Moth Work.*
Robert C. Botsford, *Deputy in Charge of Mosquito Work.*
Miss Gladys M. Finley, *Clerk and Stenographer.*[1]
Miss Grace A. Foote, B.A., *Secretary.*[2]
H. W. Coley, Westport } *Apiary Inspectors.*
A. W. Yates, Hartford

Mr. Walden has continued to serve as chief photographer, has had charge of exhibits for the department, has been in charge of the office during the absence of the Entomologist, and has assisted in scoring fruit and in the general work of the department. He has also continued his researches on the imported currant worm, *Pteronidea ribesi* Scop.

Mr. Zappe has continued in charge of the inspection of nursery stock, and of the clean-up work around infestations of the European corn borer, in co-operation with the Federal Bureau of Entomology. He has collaborated with Dr. Garman in the study of the plum curculio in apple orchards, and with Mr. E. M. Stoddard of the Botany Department, in dusting and spraying experiments in apple orchards.

Dr. Garman has continued his researches on the Oriental peach moth, and in co-operation with Mr. Zappe has carried on the investigations of the plum curculio in apple orchards, on the five-year program begun in 1922. Dr. Garman has given much attention to the chemical changes taking place in combination spray mixtures, and in collaboration with Mr. R. E. Andrew of the Department of Analytical Chemistry, published the results as Bulletin 278, entitled, "A Chemical Investigation of Some Standard Spray Mixtures," issued in May, 1926. Dr. Garman has also given some attention to treatment for the American foul brood of bees, and observations on the European red mite and other species of mites, but his studies on the Oriental peach moth and the plum curculio have required most of his time. Dr. Garman has constantly revised and added to his manuscript on the Odonata or dragonflies of Connecticut, which will soon be published as a bulletin of the State Geological and Natural History Survey of Connecticut.

Mr. Friend has nearly completed his studies of the bionomics of

[1] Resigned May 1.
[2] Beginning May 1.

the birch leaf skeletonizer, and is now preparing it as his thesis for the degree of doctor of philosophy, and it will later be published as a Station bulletin. Mr. Friend has experimented in controlling the spruce gall aphid, and the results are published in this report. Mr. Friend was also in charge of the life-history investigations of the Asiatic beetle, and was assisted by Mr. Paul A. Davis, who was employed from April 6 to November 30 on this work. Mr. Friend has made some tests, at the Station farm at Mount Carmel, for the control of the cabbage maggot, squash vine borer, and several other insects attacking vegetable crops.

The gipsy moth work has been carried on efficiently as in former years under Deputy John T. Ashworth and his assistant, James A. McEvoy, with headquarters at Danielson. This work is done in co-operation with the Federal Bureau of Entomology.

Mr. Botsford has continued to serve as Deputy to Director Slate in charge of mosquito elimination work.

Mr. J. Peter Johnson, formerly connected with the Japanese beetle laboratory of the Bureau of Entomology, at Riverton, N. J., was employed, beginning April 12, in charge of quarantine enforcement and soil treatment on account of the Asiatic beetle. During the season for soil treatment, about 21 men were employed, these being largely high-school boys, as they were the most readily available form of help that could be obtained at short notice.

Mr. J. Leslie Rogers was employed in nursery inspection and as general assistant until the middle of September, when he entered college. Messrs. A. E. Warren, a graduate student in Yale University, and B. W. McFarland also helped inspect nurseries, as did Dr. W. R. Hunt of the Botany Department.

Messrs. A. W. Yates, Hartford, and H. W. Coley, Westport, have continued to inspect apiaries, as in former seasons, working on a *per diem* basis.

Miss Gladys M. Finley, who for seven years served very acceptably as clerk and stenographer, resigned May 1, and was married in September. Miss Grace A. Foote, who was employed in the department from 1915 to 1918, was appointed Secretary, beginning May 1.

All members of the staff have served faithfully, and to them in no small measure is due whatever degree of success has been reached in the work of the department during the year.

The Entomologist has directed the work of the department and attended to the office correspondence. He has continued to serve as Associate Editor of the *Journal of Economic Entomology*, as Insect Pest Reporter in Connecticut for the Insect Pest Survey of the Bureau of Entomology, and as Chairman of the Tree Protection Examining Board. Since October, 1925, he has also been Superintendent of the Geological and Natural History Survey of Connecticut.

The chief activities of the department are described in the following pages of this report.

INSECT COLLECTION

The Station collection of Connecticut insects is believed to be the most complete of any in existence and has been accumulated during the past twenty-five years. About 90 per cent. is Connecticut material. The following table shows the statistics based upon an inventory made in November, 1926:

STATISTICS OF INSECT COLLECTION

Order	No. of Conn. Species and Varieties	Extra Conn. Species and Varieties	Total	Type Material
Thysanura	9	..	9	
Isoptera	1	..	1	
Corrodentia	8	..	8	
Plecoptera	11	..	11	
Ephemerida	8	..	8	
Mallophaga	1	..	1	
Neuroptera	15	..	15	
Mecoptera	6	..	6	
Trichoptera	26	..	26	
Odonata	114	..	114	
Euplexoptera	2	..	2	
Orthoptera	100	3	103	
Thysanoptera	10	..	10	
Homoptera	474	24	498	1 type; 5 co-types
Heteroptera	324	50	374	20 Conn. paratypes; 25 ex-Conn.
Leidoptera	968	259	1,227	1 co-type
Siphonaptera	1	..	1	
Diptera	771	27	798	
Coleoptera	1,874	235	2,109	1 type
Hymenoptera	924	40	964	129 types; 12 paratypes
	5,647	638	6,285	131 types; 32 Conn. paratypes 6 co-types; 25 ex-Conn. paratypes

ENTOMOLOGICAL FEATURES OF 1926

The beginning of the season was cool, and all plant development was retarded. Nearly all kinds of insects were from one to three weeks later than usual in making their seasonal appearance. Low temperatures and scanty rainfall prevailed until after the middle of July. Consequently it was not a favorable season for early crops.

Fruit Insects

The notes and observations upon which this report is based were gathered from various sources. Some came from the members of the committee on injurious insects of the Connecticut Pomological Society, and others from correspondence, but the majority were gleaned by Messrs. Zappe and Stoddard on their visits to more than fifty orchards during the spring and summer.

The rosy apple aphid, *Anuraphis roseus* Baker, was less prevalent than usual in most orchards. Though present in many of them, real injury occurred in only a few localities. In the vicinity of Rockville some injury was observed on June 23, and at Ledyard, August 17, in one orchard there were many curled leaves and injured fruit clusters. A few aphids were noticed at Southington and Farmington April 28, Cheshire and Middlefield May 7, Milford May 17, Cannondale May 18, New Britain May 21, Thomaston and Washington May 24, Cornwall May 25, Branford and Guilford June 8, Wallingford and Southington June 16, Pomfret, Woodstock and Lebanon June 18, Niantic, Montville and Mystic June 18, and Hazardville June 23. In most places this pest was well controlled by natural enemies.

The green apple aphid, *Aphis pomi* De Geer, was very plentiful at Meriden, June 16.

The woolly apple aphid, *Eriosoma lanigerum* Hausm., was received on apple from West Haven, May 7, and West Hartford, October 20.

The apple red bug, *Lygidea mendax* Reut., was very scarce and no traces of it were observed in 33 orchards visited. Slight indications of its work were noticed at Milford, May 26, Southington, June 16, Woodstock, June 17, and Montville, June 18.

The grape phylloxera, *Phylloxera vitifoliae* Fitch, was received from New Britain, June 29.

The European red mite, *Paratetranychus pilosus* C. & F., caused some injury in orchards not receiving a dormant spray of miscible oil: there was little indication of its presence in orchards receiving such treatment. This pest was abundant at North Farms, Wallingford, May 14, Cheshire, May 17, Cannondale and Greenwich, May 18, New Britain, May 21, Thomaston, May 24, Milford, May 26, and Meriden, June 16. A few were noticed at Middlefield, May 7, Milford, May 17, Farmington and Newington, May 21, Litchfield and Torringford, May 24, Cornwall, May 25, North Farms, Wallingford, and Southington, June 16, and Montville, June 18. Specimens of eggs on apple were received from West Hartford, October 20.

Leafhoppers, *Empoä rosae* Linn., were unusually abundant in apple orchards, and caused some injury by spotting the leaves, and the excrement soiled the fruit late in the season. Though

apparently not present at all in some orchards, it was abundant at Milford, May 26, and was present at North Farms, Wallingford, May 14, Greenwich and Cannondale, May 18, Farmington, New Britain and Newington, May 21, Thomaston, Torringford and Washington, May 24, Cornwall and Bantam, May 25, Wallingford and Clintonville, June 2, Branford and Guilford, June 8, Meriden and Southington, June 16, Pomfret, Woodstock and Lebanon, June 17, Montville and Mystic, June 18, and Rockville, June 23. Mr. Drew thinks that leafhoppers were more abundant on trees treated with dust than on sprayed trees, but in the experiments of Zappe and Stoddard little difference could be detected.

The pear psylla, *Psylla pyricola* Forst., was rather more abundant than usual, particularly at Greenwich, at Mystic, June 18, and on one tree at Hazardville, June 23. Eggs and adults were present at Farmington, April 28, and a few nymphs were noticed at Newington, May 21. It was absent from the orchard visited at Washington, May 24.

The pear midge, *Contarinia pyrivora* Riley, was present and caused some injury at Meriden, June 16, where about 80 per cent of the fruit was infested.

Specimens of the pear leaf blister mite, *Eriophyes pyri* Nal., were received from Waterbury on May 25, and the pest was reported from Union by Mr. Tucker.

The sinuate pear borer, *Agrilus sinuatus* Oliv., has now spread eastward as far as New Haven, and two trees injured by the larvae were observed in September.

The Eastern tent caterpillar, *Malacosma americana* Fabr., was extremely abundant throughout the State, though from the history of former outbreaks we expected to see signs of subsidence. The caterpillars were numerous in orchards at Farmington, April 28, Middlefield, May 7, and Wallingford, June 2. Egg-masses were received at the Station from Wallingford, January 26, Milford, March 3, Branford, March 30, New Haven, July 15, and West Hartford, October 20.

The plum curculio, *Conotrachelus nenuphar* Hbst., was late in appearing but caused about the usual amount of damage, though perhaps better control was obtained by spraying than heretofore. No injury was reported from 27 orchards visited, but this insect or its work was observed at Wallingford, June 2, Branford, June 8, Southington, June 16, Pomfret and Lebanon, June 17, Niantic, Montville and Mystic, June 18, and Hazardville, June 23. Specimens of injury were received from New Haven, June 26, Norwalk, July 9 and November 15, Milford, November 17, and Danbury, November 24. Curculio grubs in almond were received from Stamford, July 11. These were probably plum curculio grubs, but the adults have not been reared.

The San José scale, *Aspidiotus perniciosus* Comstock, is not

troublesome in orchards receiving a dormant spray of lime-sulphur or miscible oils, but still causes some injury on untreated trees and shrubs. Specimens were received at the Station on apple from West Haven, May 7, New Haven, September 3, and Old Saybrook, December 2. The scurfy scale, *Chionaspis furfura* Fitch, was received from Guilford on apple, September 1. *Lecanium corni* Bouché was received from Seymour, March 29, on grape.

The apple maggot, *Rhagoletis pomonella* Walsh, was present as usual and infested fruit was noticed in many localities. Material was received from Saugatuck, October 13, Mystic, November 13, and Milford, November 17. Late spraying with lead arsenate with two applications in July, one just after July 4, and another soon after July 20, will usually control this pest. We have even made an application during the first week in August, but this is recommended only on the late-ripening varieties.

The fall canker worm, *Alsophila pometaria* Harris, was present as usual in certain localities, but perhaps caused less injury than in 1925. Slight injury was noticed in Greenwich, May 18, Milford, May 26, Wallingford, June 2, and Rockville, June 23.

There were complaints from Bolton of climbing cutworms eating grape buds and strawberry crowns, on May 17. Specimens submitted proved to be *Noctua unicolor* Walk. Also at Wallingford May 14, climbing cutworms ate the buds from young apple trees budded the preceding summer; adults were reared and proved to be *Feltia subgothica* Haworth.

At North Farms, Wallingford, May 14, a few specimens of the bud moth, *Tmetocera ocellana* Schiff., were noticed. The red-banded leaf-roller, *Eulia velutinana* Walk., was present in orchards as usual late in the season, though probably somewhat less than in 1925. On sprayed trees this injury was less than one-third that of the check or untreated trees. The apple leaf-crumpler, *Mineola indiginella* Zell., was more abundant than usual on unsprayed apples and quinces in New Haven and Hamden. Spraying with lead arsenate is the remedy for these leaf feeders.

The Oriental peach moth, *Laspeyresia molesta* Busck, was prevalent to about the same extent as in 1925, causing more injury in some orchards and less in others. The average infestation of the fruit of late varieties was probably not much above 10 per cent. No good control measures have yet been found.

The apple and thorn skeletonizer, *Hemerophila pariana* Clerck, which in 1923 caused all unsprayed apple trees to become brown in July, caused no noticeable injury in 1926, though traces of it could be found nearly everywhere.

Injury to twigs through the oviposition of tree crickets was received on apple from Collinsville, June 3, and on cherry from Mystic, October 30. *Œcanthus nigricornis* Walker is the species

responsible. Twigs are apt to break off at the point where the eggs are laid.

Specimens of the spotted grape-vine beetle, *Pelidnota punctata* Linn., were received from Woodbridge, August 5, where they were feeding upon grape foliage.

The larva of the leopard moth, *Zeuzera pyrina* Linn., tunneling in the wood of a young apple tree was received from Danbury, August 12.

The rose chafer, *Macrodactylus subspinosus* Fabr., was less abundant than usual, and nearly a week later in appearing. The first beetle was noticed in New Haven on June 17.

The codling moth, *Carpocapsa pomonella* Linn., was somewhat less abundant than usual.

Insects Attacking Vegetable Crops

For many of the notes and observations regarding vegetable insects I am indebted to Mr. A. E. Wilkinson, vegetable specialist of the Extension Department, Connecticut Agricultural College, Storrs.

Injury by cutworms was serious during the month of May, and reports were received from all eight counties in the State. The first report came from New Haven County on May 1, and on May 12 one Westville grower reported that he had lost 5,000 out of 6,000 tomato plants. It is certain that vegetable growers could greatly reduce their losses if they would each year distribute poisoned bran mash in their fields a few days before setting their plants, or in case of seeding in the field, before much injury has occurred.

Mr. Wilkinson reported injury by wireworms at Mount Carmel, May 1, and to potatoes at Vernon in September.

The pea aphid, *Illinoia pisi* (Kalt.), was prevalent and caused great damage in June in many sections of the State. Mr. Wilkinson observed it at Southington, Plainville, Glastonbury, Wethersfield, Windsor and East Granby, June 22; he found it very abundant in New Haven County June 26, and a heavy infestation throughout Fairfield and Litchfield Counties, July 10. In my own garden, some late-planted peas, when about four inches tall, were noticed to be heavily infested. I killed nearly all the aphids by directing a spray of nicotine downward upon the plants but the growth of the plants had already been checked and a very light crop resulted.

The imported cabbage worm, *Pieris rapae* Linn., was about as abundant as usual, particularly late in the season. Mr. Wilkinson reported few at Danbury and Stratford, June 5, but found them abundant everywhere September 25.

The cabbage looper, *Autographa brassicae* Riley, was everywhere abundant in September. The larvae eat holes into the center of the heads.

The cabbage aphid, *Brevicoryne brassicae* Linn., was not very injurious but was reported by Mr. Wilkinson as being present in a field of 56,000 plants at Northfield, July 10. At the Station farm, Mount Carmel, the insect was noticed, but it caused no injury.

The cabbage maggot, *Hylemyia brassicae* Bouché, caused about the usual amount of damage, and was reported from Danbury, June 5, Wethersfield, June 22, and New Haven County, June 26. It was present in abundance at the Station farm at Mount Carmel, where Mr. Friend carried on his experiments. So far he has not found any method of control that gives better results than treating the plants with corrosive sublimate, one ounce in ten gallons of water.

The diamond-back moth, *Plutella maculipennis* Curtis, was more prominent than usual. The first specimens that came to my attention were on a head of cabbage brought from Southington by Mr. Wilkinson and given to me at the annual Field Day at the Station farm, July 28. Mr. Wilkinson also reported this pest as being present on cabbage and cauliflower at Cheshire, Wapping and Taftville on September 25. It was also present at the Station farm at Mount Carmel. This is a European pest, and there are two or three generations each year in the northern states. In Colorado there are seven broods and in the South breeding is almost continuous. The larvae eat holes on the under side of the leaves. They do not eat entirely through but leave the upper epidermis. The holes show as transparent spots when held to the light. Heavily spraying the under surface of the leaves with lead arsenate is the remedy. Possibly dusting with powdered lead arsenate may control this pest but I have not had an opportunity to try it.

The striped cucumber beetle, *Diabrotica vittata* Fabr., was reported as being less common than usual at East Hartford, Glastonbury, and Plainville, June 22. In my own garden at Mount Carmel where squashes were grown the year before, there were no beetles until late in June when the plants were about six inches high; then the beetles came upon them in great numbers and bid fair to ruin the plants. On June 28, the plants were dusted with calcium fluosilicate, which cleaned out the beetles without injuring the plants. Some of the plants, however, were injured by the grubs tunneling in the main root; this was followed by wilt and the vines died.

The squash bug, *Anasa tristis* De Geer, was very abundant at Mount Carmel late in July. It was reported from Vernon,

Ellington, Woodstock, Brooklyn, Canterbury and Ledyard on July 17. The young bugs can be killed by a spray of 40 per cent nicotine solution, 1 part in 150 parts of water.

The squash lady beetle, *Epilachna borealis* Fabr., was reported from Ledyard July 17, by Mr. Wilkinson. I also observed it in a garden in Ledyard, August 17. Both larvae and adults were present. The larvae are yellow, with black spines on the back. They have the habit of marking out on the upper side of a leaf a circular or oval area half or three-fourths of an inch in diameter, and then eating off the green tissue within the area outlined. Spraying with lead arsenate is a remedy.

The squash borer, *Melittia satyriniformis* Hubn., continues to be a serious pest and was apparently more abundant than usual in 1926. In normal seasons, nearly all eggs have been laid by August 1, but the past season the adults were present on the vines during the first half of August and I found one moth at Ledyard on August 17. As a rule early-planted summer crook-necks will produce a crop before the squash borer attacks them. Experiments at the Massachusetts Station a few years ago showed that by spraying the bases of the vines once a week during July with 40 per cent nicotine sulphate solution, one part in 150 parts of water, the eggs will be killed. In Mr. Friend's experiments at the Station farm at Mount Carmel, he found that many eggs were laid on the vines at points from four to ten feet from the base or beyond the portion covered by the spray. It is very difficult to spray all parts of a vine after it has begun to run. Even with such a spray treatment it is advisable to cut out the borers, and to cover each vine with soil, thus enabling it to make new roots.

The potato flea beetle, *Epitrix cucumeris* Harris, was common nearly everywhere. Mr. Wilkinson reported it on lettuce and carrots at Mount Carmel May 1; on tomatoes and egg-plants at North Haven, New Haven, Hamden, Branford and Milford, May 29; on tomatoes at Stratford, Westport, Danbury, Bethel and Thomaston, June 5; on cucumber at East Hartford, Glastonbury and Plainville, and on potatoes and tomatoes at Glastonbury, June 22. This is a hard pest to control but on a few plants in the home garden I have freed the plants by spraying them with nicotine sulphate solution.

Asparagus beetles were present in about the usual numbers. The common asparagus beetle, *Crioceris asparagi* Linn., is the one which is responsible for most of the injury to foliage and new shoots. The spotted asparagus beetle, *Crioceris 12-punctata* Linn., causes some injury by the adult beetles feeding on the new shoots and foliage, but the grubs feed chiefly on the seeds in the berries. Mr. Wilkinson reported the 12-spotted beetle more common than the other in New Haven County June 26, and also found it present at Groton, Pawcatuck, Norwich, Canterbury,

Wauregan and Danielson on July 17. He also reported the common asparagus beetle from Hamden, North Haven, Cheshire and Branford, May 29; Southington, Plainville, Bristol, Wethersfield, Windsor, Windsor Locks, East Granby, East Hartford, South Windsor and Storrs, June 22; and from Groton, Pawcatuck, Norwich, Canterbury, Wauregan and Danielson, July 17. Larvae and eggs were received from Ridgefield, June 22. As a rule clean cutting over the field as long as the cutting season lasts is a good practice, though some growers leave a few trap plants around the margins, to be destroyed later. After the cutting season ends, and on new beds, the foliage can be heavily sprayed with lead arsenate, with a casein spreader to kill both adults and larvae. The latter may be killed in the home garden by spraying with nicotine solution.

The horse-radish flea beetle, *Phyllotreta armoraciae* Koch, was reported from East Hartford, Wethersfield, and Storrs, June 22.

The black blister beetle, *Epicauta pennsylvanica* (De Geer), was received at the Station, July 27, feeding on Swiss chard, and the margined blister beetle, *Epicauta marginata* Fabr., from Wethersfield, July 28, feeding upon tomato.

The corn ear worm, *Heliothis obsoleta* Fabr., was apparently less troublesome than usual, and the only specimens received at the Station came from New Britain, October 9, on sweet corn.

The parsley stalk-weevil, *Listronotus latiusculus* Boh., was received from New Haven, July 15.

The stalk borer, *Papaipema nitela* Guen., was present and caused the usual amount of injury in all kinds of herbaceous plants. One specimen in corn was received at the Station from New Haven, July 22. Its work was observed in many places.

Shade and Forest Tree Insects

Two of the most important features concerning shade tree insects are the discovery of the satin moth in the State and the prevalence of the birch leaf miner. The satin moth, *Stilpnotia salicis* Linn., has now invaded Connecticut, and one egg-mass was found in Thompson and another in Stonington by Federal men, and these two towns are now under Federal quarantine on account of this insect. No poplar or willow trees may be moved interstate from these towns without a Federal inspection and certificate.

The birch leaf miner, *Fenusa pumila* Klug, has now spread throughout southern New England and southeastern New York, and is beginning to attract considerable attention. Specimens have been received at the Station from Fairfield, June 15, Norwalk, June 18, East Haven, June 24, Hartford, July 28 and August 30, Westport, August 11, Waterford, August 13, and Danbury, August 19.

The elm sawfly leaf miner, *Kaliofenusa ulmi* Sund., continues to attack elm trees in the northwestern portion of the State. Specimens were received from Norfolk on June 30.

The imported pine sawfly, *Diprion simile* Hart., occurs here and there on white pine but causes little damage. Specimens were received from New Haven, July 21 and September 29. An allied species, *Neodiprion lecontei* Fitch, was received from Danbury, September 10. This species attacks pitch pines and other three-leaved species. Spraying with lead arsenate will protect the trees from being devoured by sawfly larvae.

The fall webworm, *Hyphantria cunea* Drury, was observed in late summer on fruit, shade, and forest trees in all parts of the State. It was seemingly more abundant than usual, particularly in Fairfield and Hartford Counties.

The European pine shoot moth, *Rhyacionia buoliana* Schiff., was received on red pine from Greenwich, April 9, and on Scotch pine from Southport, June 17.

The walnut caterpillar, *Datana integerrima* S. & A., was present as usual, and specimens were received from Saybrook, August 24, and from Collinsville, September 8.

The spruce bud worm, *Harmaloga fumiferana* Clem., is responsible for occasional damage to spruce trees in Connecticut, and specimens were received from West Haven, June 14.

The white-marked tussock moth, *Hemerocampa leucostigma* S. & A., attacks fruit, shade, and forest trees, and specimens were received from Middletown, April 27, and from Granby, June 16.

The pine tube moth, *Eulia pinatubana* Kearf., occasionally causes partial defoliation of white pine trees, and specimens were received from New Haven, October 5. Spraying with lead arsenate is the remedy.

The blotch leaf miner of white oak, *Lithocolletis hamadryadella* Clem., frequently injures and disfigures white oak trees by mining the leaves. No remedy can be advised. Specimens were received from Hartford, July 30.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, continues to be a rather important pest on various species of pines in ornamental plantings, particularly in sheltered situations. Specimens were received on Scotch pine from Hartford, April 5, from New Haven, April 19, and from Watertown, May 17.

The spruce gall aphid, *Adelges abietis* Linn., commonly disfigures Norway and other spruce trees in Connecticut, and in nurseries and ornamental plantings spraying must now be practiced to prevent the formation of galls. Specimens were received from Bolton, February 5, New Preston, June 14, Middlebury, July 15, Middletown, August 18, Norwich, September 15, and Forestville, October 4. Experiments in controlling this pest were

conducted by Mr. Friend of this Department, and are described on page 223 of this Report.

The gall aphid of the blue spruce, *Gillettea cooleyi* Gillette, forms terminal galls larger than the preceding. A variety of *cooleyi* (var. *coweni* Gillette) appears as a woolly aphid on Douglas fir, and specimens were received from Cheshire, July 5.

The spiny aphid gall of witch hazel, *Hamamelistes spinosus* Shimer, was received from Naugatuck, October 5.

A woolly aphid on maple, *Neoprociphilus aceris* Mon., was received from Winsted, July 22.

A gall-forming aphid, *Colopha ulmicola* Fitch, was received from New Britain, on elm, July 8.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., is one of the most common scale insects in Connecticut and attacks a large number of different kinds of trees and shrubs. This insect was received on box from New London, February 24, and on *Juglans* from Plantsville, June 8.

The oak-gall scale, probably *Kermes pubescens* Bogue, was received on oak from Norwalk, August 16.

The tulip tree scale, *Toumeyella liriodendri* Gmel., is rather common on tulip trees, and a specimen was received from Middletown, August 2, and from New London, December 20.

The cottony maple scale, *Pulvinaria vitis* Linn., which has been quite common on silver maples around Stamford for the past few years, was received from Westport, August 11, and from New Haven, July 21.

Specimens of a Japanese scale, *Leucaspis japonica* Cockerell, were received from Greenwich, December 14, on maple.

The oak twig pruner, *Hypermallus villosus* Fabr., is responsible for the cutting of small twigs of oak and some other trees, and these twigs fall upon the lawn, making more or less litter. The insect usually falls in the stem of the severed twig, and gathering and burning the twigs promptly is one method of control. Specimens were received from Greenwich, August 16.

The maple borer, *Glycobius* (*Plagionotus*) *speciosus* Say, is present each year in Connecticut and causes much injury to sugar maple trees, whether cultivated or growing wild. A specimen of the adult beetle was received from New Haven, July 15.

The locust leaf miner, *Chalepus* (*Odontota*) *dorsalis* Thungb., was received from Danbury, August 19. The larvae mine the leaves, which turn brown in July and August.

Specimens of red pine were received from Clark's Corners, July 21, the leaders of which had been eaten in a peculiar manner. Though no insect could be found on the specimen twigs, it appeared to be the work of insects, and the pales weevil, *Hylobius pales* Boh., is suspected of having caused the injury.

was found in twenty separate fields and gardens in the five towns of Bridgeport, Saybrook, New London, Groton, and Stonington. Clean-up work was done around each infestation in late fall and spring. The entire region was again scouted in 1926 and no signs of the pest found at Bridgeport and Saybrook, but one infestation was found at Woodmont in the town of Milford, and several were found in East Lyme, Waterford, New London, Groton and Stonington. These five towns in New London County will soon be placed under Federal quarantine.[1] No other part of the state has as yet become generally infested, and we aim to prevent this as far as possible, particularly on account of the important seed-corn interests of the state. But our control work depends somewhat on the size of our appropriations, and probably the time will soon come when it cannot entirely be held back, even with large appropriations.

Much progress has been made during the year in a study of the life history, habits, and methods of control of the Asiatic beetle, *Anomala orientalis* Waterhouse, mentioned in my last report, the grubs of which feed upon the roots of grass in lawns in the western part of the city of New Haven. It is found that the beetles fly somewhat and feed slightly in the flowers of roses, hollyhocks, etc. Some 43 acres of lawns and gardens in New Haven were treated with a specially prepared emulsion of carbon disulphide. The area has been placed under quarantine in order to prevent, so far as possible, the spread of the insect through artificial means.

The Japanese beetle, *Popillia japonica* Newman, which has been such a nuisance on fruit, flower and vegetable crops in New Jersey, Pennsylvania, and northern Delaware, has now spread northward, infesting the western end of Long Island and Westchester County in New York, and in late summer a few of the beetles were found in Stamford, Conn. As Port Chester, N. Y., is also infested, it was necessary to include Greenwich with Stamford in the Federal quarantine, and both towns have since been placed under State quarantine. Though control measures may retard the natural spread of this insect, I doubt if it is humanly possible to prevent it from infesting the entire State within a few years if it continues to spread at the same rate that it has since it was discovered in this country ten years ago. The beetles feed upon the foliage, flowers, and fruit of many kinds of trees and plants, including fruit trees, roses, sweet corn, beans, etc. In the region around Philadelphia, not only must the vegetables be inspected and certified before shipment, but some of them must be given special packages and stored under screens, and during

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[1] A Federal quarantine, effective March 1, 1927, has been placed on the towns of East Lyme, Waterford, New London, Groton and Stonington.

the period when the beetles fly about in swarms, vegetable shipments are stopped entirely for a few days.

The Colorado potato beetle, *Leptinotarsa decemlineata* Say, was rather less abundant than usual throughout the State.

White grubs, *Phyllophaga* sp., were reported as injuring potatoes at Vernon in September.

Miscellaneous Insects

Specimens of the American cockroach, *Periplaneta americana* Linn., were brought to the Station on August 5, from a dump along the Boulevard, New Haven, where they were present in large numbers; also from a factory restaurant in New Haven, October 4.

The large garden slug, *Limax maximus* Linn., was received from New Haven, June 14. This slug often does considerable damage by feeding upon the leaves of vegetable and flowering plants in gardens, and leaves a slimy trail wherever it crawls. These animals feed chiefly at night and hide away during the daytime. When found, they can easily be destroyed by shaking a little table salt upon them. Foliage which is not for food may be sprayed with lead arsenate, and food plants may be protected by surrounding them with a barrier of air-slaked lime or fine coal or wood ashes.

General Index to Reports

A general index to the first twenty-five reports of the State Entomologist of Connecticut has been prepared and published as Bulletin 281 of this Station. Though each Report has its own index, for ready reference this general index is of great assistance, as it saves consulting the indices of the separate Reports. There are now many scientific and public libraries, and individuals, particularly entomologists, that bind these Reports together, and wherever such plans are contemplated, the general index should be secured and made a part of the set. It also contains a list of errata and an index to all text figures and plates which have appeared in the twenty-five Reports.

Convention of Entomological Workers

The third convention of Entomologists working in Connecticut was held at the Connecticut Agricultural College, Storrs, October 29, 1926. The program was similar to that of last year and, besides containing papers of Connecticut entomologists and those of Federal men working co-operatively within the State, included also papers by Dr. E. P. Felt, State Entomologist, Albany, N. Y.,

and Professor A. I. Bourne, Agricultural Experiment Station, Amherst, Mass., on subjects of much interest to Connecticut workers. The meeting was held in the pleasant assembly room of the new Community House, and an excellent luncheon was served in the College dining hall. About 54 attended this meeting. Mr. Loren B. Smith was unable to be present, and his place was filled very acceptably by Mr. E. Avery Richmond. The program was as follows:

Program

A. M.

10:00 Greetings.
C. L. Beach, President, Connecticut Agricultural College, Storrs, Conn.

10:15 The Training of Entomological Investigators.
Prof. G. H. Lamson, Jr., Connecticut Agricultural College, Storrs, Conn.

10:30 Summary of Six Years' Experiments in Orchard Dusting and Spraying.
M. P. Zappe, Connecticut Agricultural Experiment Station, New Haven, Conn.

11:00 Some Insect Pests Which Have Recently Appeared in Connecticut.
W. E. Britton, State Entomologist, New Haven, Conn.

11:15 The Occurrence of *Autoserica japonica* in the United States.
E. P. Felt, State Entomologist, Albany, N. Y.

11:30 Present Status of the European Corn Borer in the United States.
L. H. Worthley, In Charge of Federal Control Work, Arlington, Mass.

12:00 Recent Developments in the Control of the Japanese Beetle.
Loren B. Smith, In Charge of Federal Work, Riverton, N. J.

P. M.

1:00 Luncheon.

2:00 Present Status of the Gipsy Moth, Brown-tail Moth and Satin Moth.
A. F. Burgess, In Charge of Federal Moth Work, Melrose Highlands, Mass.

2:45 Recent Observations on the Codling Moth in Massachusetts.
A. I. Bourne, Agricultural Experiment Station, Amherst, Mass.

3:00 Habits and Life History of the Asiatic Beetle, *Anomala orientalis*.
R. B. Friend, Agricultural Experiment Station, New Haven, Conn.

3:30 Soil Treatment and Scouting for the Control of the Asiatic Beetle.
J. Peter Johnson, Agricultural Experiment Station, New Haven, Conn.

4:00 Work of the Season with the Oriental Peach Moth.
Philip Garman, Agricultural Experiment Station, New Haven, Conn.

4:30 Recent Studies on the Bean Weevil.
J. A. Manter, Agricultural College, Storrs, Conn.

The following were present: William J. Ahearn, Westerly, R. I.; John T. Ashworth, Danielson, Conn.; Ellery Atwood, Thomaston, Conn.; C. L. Beach, Storrs, Conn.; H. L. Blaisdell, Melrose Highlands, Mass.; A. I. Bourne, Amherst, Mass.; W. E. Britton, New Haven, Conn.; A. F. Burgess, Melrose Highlands, Mass.; C. A. Clark, Greenwich, Conn.; G. M. Codding, Mount Vernon, N. Y.; C. W. Collins, Melrose Highlands, Mass.; W. A. Collins, New Milford, Conn.; O. B. Cook, Danielson, Conn.;

H. E. Cooke, Danielson, Conn.; R. G. Cooper, Colebrook, Conn.; S. S. Crossman, Melrose Highlands, Mass.; P. A. Davis, New Haven, Conn.; William W. Eells, Manchester, Conn.; C. M. Emerson, Hartford, Conn.; E. P. Felt, Albany, N. Y.; R. B. Friend, New Haven, Conn.; C. W. Frink, Brooklyn, Conn.; Philip Garman, New Haven, Conn; A. J. Gilbert, Jewett City, Conn.; S. P. Hollister, Storrs, Conn.; H. C. Huckett, Riverhead, N. Y.; J. Peter Johnson, New Haven, Conn.; John F. Keough, Willimantic, Conn.; Dolor La Belle, Ballouville, Conn.; G. H. Lamson, Jr., Storrs, Conn.; A. J. Lannon, Providence, R. I.; Allen Latham, Norwichtown, Conn.; J. W. Longo, Danielson, Conn.; Edwin T. Lundberg, Greenwich, Conn.; J. A. Manter, Storrs, Conn.; W. E. Mattson, Colebrook, Conn.; S. E. May, Canaan, Conn.; J. A. McEvoy, Putnam, Conn.; B. W. McFarland, New Haven, Conn.; H. L. McIntyre, Albany, N. Y.; W. B. Mix, Stamford, Conn.; R. C. Newton, Storrs, Conn.; W. J. Powers, Boston, Mass.; F. C. Rich, Ansonia, Conn.; E. Avery Richmond, Riverton, N. J.; J. B. Riley, Killingly, Conn.; W. L. Slate, Jr., New Haven, Conn.; R. A. Spencer, Hartford, Conn.; O. W. Spicer, Stamford, Conn.; A. E. Stene, Kingston, R. I.; B. H. Walden, New Haven, Conn.; J. R. Ward, New London, Conn.; L. H. Worthley, Boston, Mass.; M. P. Zappe, New Haven, Conn.

INSPECTION OF NURSERIES IN 1926

W. E. Britton and M. P. Zappe

The annual inspection of growing nursery stock was commenced July 6 and finished in September except for a few scattered nurseries, the final inspection being made November 16. This work was in charge of Mr. Zappe, who was assisted by J. L. Rogers, A. E. Warren, and Dr. W. R. Hunt. Assistance in a few nurseries was rendered by B. W. McFarland, A. D. McDonnell, B. H. Walden, E. M. Stoddard, J. E. Riley, J. T. Ashworth, R. C. Botsford, and W. E. Britton.

Dr. Hunt of the Botany Department was assigned to this work in order to give special attention to plant diseases which might be found in the nursery, and on certain days when he could not be present, Mr. A. D. McDonnell was detailed to go in his place.

In addition to the inspections made by the nursery inspectors, the gipsy moth scouts were instructed to make careful examinations for gipsy moth eggs in and around all nurseries in the quarantined area, and to report to the office in case any were found. No gipsy moth infestations were discovered in or near any Connecticut nursery in 1926.

In 46 nurseries no important pests were found. A list of insects and plant diseases found in nurseries during the annual inspection of 1926, together with the number of nurseries infested by each, is given below:

Pests Found in Nurseries in 1926

Nurseries uninfested	46

INSECTS

Name	No. Nurseries
Aphids, apple, green	43
woolly	35
on caragana	1
catalpa	1
cherry	1
currant	1
spiraea van Houtei	1
viburnum	1
willows	2
Spruce gall *Chermes abietis*	35
" *cooleyi*	7
Larch *Chermes*	5
Pine bark *Chermes*	7
Apple and thorn skeletonizer	19
Birch leaf miner	20
Borer in apple	1
ash	1
Mugho pine	1
lilac	2
maple	1
peach	1
poplar	1
red pine shoots	1
rose	1
willow	2
Cecropia caterpillar	1
Cherry and pear slug	17
Curculio, walnut	1
Elm leaf beetle	4
Fall webworm	11
Lace bugs on linden	1
quince	1
oak	1
rhododendron	23
sycamore	1
Janus abbreviatus	2
Juniper webworm	2
Leafhoppers on apple	35
grape	1
pear	1
rose	1
Leaf miners in *Catalpa bungei*	9
magnolia	1
maple	1
peach	2
tulip tree	1
Maple worm, green-striped	1
Mite, European red	5
pear blister	20
spruce	2
on *Amelanchier*	1
birch	1
cedar	1
silver maple	2
willow	1
Oriental peach moth	14
Pear psylla	7
Poplar flea beetle *Crepidodera helxines*	2
leaf beetle *Lina scripta*	6
Red-humped caterpillar	7
Rose chafer	2
stem girdler	1
Sawfly *Diprion simile*	1
on birch	1
currant	2
plum	1
white pine	1
Scale, elm	14
euonymus	2
Lecanium on oak	1
Leucaspis on lilac	1
oak gall	5
oyster-shell	39
pine leaf	5
rose	10
San José	19
scurfy	2
tulip tree	1
white peach on *Catalpa bungei*	1
Spiny elm caterpillar	1
Tarnished plant bug	1
Tent caterpillar	10
Thecodiplosis liriodendri	2
White-marked tussock moth	1
White pine weevil	8
Willow leaf beetle *Plagiodera versicolora*	6
galls	2
Yellow-necked caterpillar	2

PLANT DISEASES

Name	No. Nurseries
Anthracnose on currant	1
Apple scab	38
Black knot	3
rot on apple	26
cherry	1
Blight on horsechestnut	1
Brown rot	5
Canker, poplar	32
on willow	1
Chestnut blight	1

Name	No. Nurseries	Name	No. Nurseries
Crown gall	2	Mildew on phlox	3
Leaf spot on catalpa	21	rose	40
cherry	8	*Symphoricarpus*	1
linden	1	walnut	1
maple	2	Peach yellows	1
quince	7	Raspberry anthracnose	3
rose	38	mosaic	7
strawberry	6	Rust on apple	61
tulip tree	1	ash	1
Mildew on apple	10	cedar	1
catalpa	19	Crataegus	4
gooseberry	1	quince	6
grape	4	white pine blister on *Ribes*	9
lilac	12		

From an examination of the preceding list it will be seen that the green apple aphid was found in more nurseries (43) than any other insect pest, though this does not mean that it causes the most injury. Next in number of nurseries infested comes the oyster-shell scale (39), followed by the woolly apple aphid (35), leafhoppers on apple (35), spruce gall aphid (35), lace bugs on rhododendron (23), birch leaf miner (20), pear blister mite (20), San José scale (19), apple and thorn skeletonizer (19), and cherry and pear slug (17).

Among the plant diseases found in nurseries, seemingly the rust on apple leads in prevalence (61), followed in the order given, by mildew on rose (40), apple scab (38), leaf spot on rose (38), poplar canker (32), black rot on apple (26), leaf spot on catalpa (21), mildew on catalpa (19), mildew on lilac (12), and mildew on apple (10).

In order to show how the prevalence of certain nursery pests in 1926 compares with preceding seasons, the record of them for the past seven years is given as reported by the nursery inspectors:

SEVEN-YEAR RECORD OF SERIOUS AND COMMON NURSERY PESTS

Pest	*1920*	*1921*	*1922*	*1923*	*1924*	*1925*	*1926*
Oyster-shell scale	38	36	44	42	44	38	39
San José scale	11	28	19	20	32	32	19
Spruce gall aphids	21	31	21	28	40	27	42
White pine weevil	1	1	19	17	5	5	8
Apple and thorn skeletonizer	..	..	1	18	2	8	19
Poplar canker	13	21	31	34	25	34	32
Pine blister rust (on *Ribes*)	..	2	9	6	8	7	9
Nurseries uninfested	46	36	36	32	33	34	46

The figures in the preceding table are not absolutely comparable because the number of nurseries inspected in 1925 and 1926 was about 50 per cent greater than during the other years imme-

diately preceding. Though the number of nurseries infested with a given pest may be greater in 1926 than in 1923, the percentage may be considerably less.

Number of Nurseries

The law passed in 1925 requiring nurserymen to register has operated to increase the number of nursery firms known to the State Entomologist. This increase was marked in 1925, and further increases have been noted in 1926. During the calendar year of 1926, 182 nursery inspections were made. The list contains 162 names; 12 of these were inspected twice, once in the spring and again in the fall, and 174 regular certificates have been granted. Eight inspections were made where the owners either have not qualified for receiving certificates or have since decided that they do not need certificates.

In addition to these regular inspections and certificates, 121 separate parcels of nursery stock have been inspected and package certificates furnished; 202 duplicate certificates have been furnished to the regular nurserymen for filing in other states.

The area of nurseries in Connecticut in 1926 was about 2,106 acres, as against 2,731 in 1925. These figures are for the most part taken from the registration blanks, and where not filled out by the owner, the inspector obtains the information, or if this is not possible, he estimates the area. All nurseries of less than an acre are given as one acre. Likewise, wherever a fraction is given, the next whole number is recorded. The list of nursery firms for 1926 contains 162 names, and is as follows:

Nursery Firms in Connecticut Receiving Certificates in 1926

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Alius, Adolf	Stamford	1	Nov. 1	299
Amelunxen & De Wyn	Yalesville	3	Sept. 3	235
Baby Blue Spruce Gardens (E. C. Pomeroy, Prop.)	New Milford	2	Aug. 14	182
Barnes Bros. Nursery Co.	Yalesville and Durham	150	Aug. 6	169
Barnes Nursery & Orchard Co.	Wallingford	50	Oct. 21	294
Barton, Robert	Hamden	1	Dec. 7	311
Beattie, W. H.	New Haven	1	Dec. 22	319
Benbow, A.	Norfolk	1	Aug. 21	192
Berkshire Nurseries (C. B. Myers, Mgr.)	Milford	10	Dec. 30	324
Bernson, Gosta M.	Cromwell	1	Aug. 21	203
Bertana, Louis (2)	Glenbrook	1	Sept. 15	264
Bertolf Bros.	Greenwich	40	Sept. 15	263
Booy, H. W.	Yalesville	3	Aug. 21	199
Brainard Nursery & Seed Co.	Thompsonville	12	Aug. 20	188
Braley & Co., S. A.	Burnside	3	Aug. 31	216

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Branford Nurseries	Branford	4	Aug. 31	217
Bretschneider, A.	Danielson	1	Sept. 4	236
Bridgeport Hydraulic Co.	Bridgeport	100	Oct. 26	295
Bristol Nurseries, Inc.	Bristol	30	Sept. 7	240
Brooklawn Conservatories (Julius Reck, Prop.)	Bridgeport	1	Aug. 27	212
Brouwer's Nurseries	New London	2	Aug. 21	194
Brown, Edgar M.	Hartford	1	Oct. 26	296
Bulpitt, Henry F.	Darien	4	Nov. 17	307
Burke, P. J. (2)	Rockville	2	Aug. 21	196
Burr & Co., C. R.	Manchester, Ellington and Durham	300	Aug. 19	183
Burr, Morris L.	Westport	1	Oct. 19	291
Burroughs, Thomas E.	Deep River	4	Aug. 5	168
Burwell, E. E. (2)	New Haven	1	Sept. 30	281
Cant, Alexander	Springdale	1	Sept. 27	277
Cardarelli, E. J.	Cromwell	2	Sept. 8	250
Case, Louis L. (2)	Simsbury	1	Sept. 7	244
Chapman, C. B.	Groton	1	Sept. 16	268
Chapman, C. E.	North Stonington	1	Sept. 8	247
Clinton Nurseries (Warren W. Richards, Prop.)	Clinton	4	Sept. 14	257
Conine Nursery Co.	Stratford	50	Sept. 2	222
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Sept. 11	255
Conn. Agr. Expt. Station (W. O. Filley, Forester)	Mt. Carmel, New Haven and Norwich	2	Sept. 18	273
Corrigan, James J.	West Haven	1	Aug. 27	215
Dallas, Inc., Alexander	Waterbury	2	Oct. 27	297
Dawson's Nursery	Willimantic	1	Sept. 14	261
Dunlap, Daniel S.	Cromwell	3	Aug. 21	202
Eager, Edward M.	Bridgeport	1	Sept. 21	275
East Rock Nursery Co. (S. Palmieri, Prop.)	New Haven	1	Sept. 28	278
Edgewood Nursery (Vidal Mackintosh, Inc.)	Stamford	1	Dec. 6	310
Eells & Sons	Manchester	1	Aug. 14	181
Elfgren, I. P. (2)	East Killingly	1	Aug. 21	205
Elm City Nursery Co. (Woodmont Nurseries, Inc.)	Woodmont	150	Aug. 25	207
Elm Grove Cemetery Association	Mystic	1	Dec. 4	309
Ensign-Bickford Co. (S. W. Eddy, Supt.)	Avon	10	Dec. 28	323
Evergreen Nursery Co.	Wilton and South Wilton	14	Aug. 14	180
Farmington Valley Nursery (Harry D. Wilcox, Prop.)	Avon	1	Aug. 31	221
Fraser's Nurseries & Dahlia Gardens	Willimantic	2	Aug. 21	204
Galligan, C. W.	North Haven	2	Sept. 3	233
Gardner's Nurseries	Rocky Hill	4	Aug. 25	206
Geduldig's Greenhouses	Norwich and Ledyard	2	Sept. 9	251
Geremia, Joseph	Yalesville	1	Sept. 7	241
Glen Terrace Nursery (J. H. Everett, Prop.)	Mount Carmel	20	Oct. 4	285

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Golden Hill Nurseries (Andrew Johnson, Prop.)	Shelton	2	Sept. 7	243
Hallock, H. G.	Washington	1	Sept. 3	228
Hanford, R. G.	Norwalk	2	Aug. 31	219
Hansen, Peter	Fairfield	2	Sept. 10	253
Hawes, F. M.	West Hartford	1	Sept. 3	225
Hearn, Thomas H.	Washington	3	Sept. 3	229
Heath & Company	Manchester	1	Aug. 6	172
Hill Top Nursery (2) (F. W. Langstroth, Prop.)	Danbury	2	Sept. 3	224
Hilliard, H. J.	Sound View	1	Aug. 31	220
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Aug. 6	170
Holcomb, Irving	Simsbury	1	Aug. 11	178
Holdridge, S. E.	Ledyard	4	Aug. 19	185
Horan, James & Son	Bridgeport	1	Oct. 6	287
Houston's Nurseries	Mansfield	12	Oct. 19	292
Hoyt's Sons Co., Inc., Stephen	New Canaan	300	Aug. 26	211
Hubbard, S. C.	Cromwell	2	Aug. 21	201
Hull, Curtis M.	Wallingford	4	Sept. 15	266
Hunt & Co., W. W.	Hartford	8	Sept. 3	223
Intravaia, Joseph	Middletown	2	Aug. 21	197
Jennings, G. S.	Southport	1	Sept. 7	242
Johnson, Tom	Stratford	1	Apr. 14	156
Jones, William	Norwalk	1	Sept. 11	254
Kelley, James J. & Son	New Canaan	4	Sept. 8	245
Kerner, Eugene	Woodbury	2	Dec. 31	325
Keystone Nurseries (H. H. Kellner, Prop.)	Danbury	1	Aug. 25	208
Leghorn, John J.	Cromwell	5	Aug. 19	186
Lewis & Valentine, Inc.	Darien	5	Oct. 27	298
Long Hill Nursery (John E. Eckner, Prop.)	Burnside	1	Sept. 3	226
Malavasi, Sam	New Haven	1	Sept. 30	282
Mallett Co., George A.	Bridgeport	1	Sept. 14	259
Maplewood Nurseries (T. H. Peabody, Mgr.)	Norwich	2	Sept. 27	276
Marigold Farm (Henry Kelley, Prop.)	New Canaan	10	Sept. 18	271
Marshall, Robert	Wethersfield	1	Sept. 4	238
Massara, Anthony	Yalesville	1	Aug. 21	200
Merwin Lane Nursery (J. W. Marvin, Jr., Prop.)	Fairfield	5	Oct. 2	283
Middeleer, Inc.	Darien	6	Nov. 6	303
Millane Tree Expert Co.	Middletown and Cromwell	2	Dec. 1	308
Minge, G. H. (2)	Rocky Hill	1	Sept. 28	279
Moraio Bros.	Stamford	1	Apr. 14	157
Morgan, William F. (Westerly, R. I.)	North Stonington	4	Sept. 8	249
New Britain Board of Water Commissioners (2)	New Britain and Southington	50	Nov. 6	302
New Haven Nurseries (Louis A. Soldan, Mgr.)	New Haven	1	Dec. 8	313
New Haven Park Commission (G. X. Amrhyn, Supt.)	New Haven	16	Sept. 8	246

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
New London Cemetery Assn. (E. E. Rogers, Pres.)	New London	1	Sept. 14	260
New London County Nurseries (W. J. Schoonman, Prop.)	New London, Norwich and Waterford ...	5	Sept. 29	280
Newington Gardens (Julius Rottenberg, Prop.)	Newington	1	Sept. 15	267
Nicolson & Thurston	Litchfield	1	Aug. 21	191
North-Eastern Forestry Co. (F. S. Baker, Mgr.)	Cheshire	56	July 30	166
Norwood Nursery	Hamden	1	Sept. 18	272
Oakland Nurseries	Manchester	5	Aug. 6	173
Ostergren, Herbert	Cromwell	2	Aug. 21	193
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	35	Oct. 4	286
Ouwerkerk & Van der Stam	Yalesville	12	Aug. 19	187
Parfitt, Mary T.	New Milford	1	Nov. 1	300
Pedersen, Anthon	Stamford	2	Dec. 7	312
Pequod Nursery Co.	Yalesville	15	Aug. 5	167
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Nov. 15	304
Pierson, A. N., Inc.	Cromwell	100	Aug. 11	174
Plumley, D. L.	Clintonville	1	Sept. 3	234
Polish Orphanage Farm	New Britain	1	Dec. 8	314
Reuman, Theodore H.	Stamford	1	Sept. 3	232
Ridgefield Florist & Nursery (W. Pinchbeck, Prop.) ..	Ridgefield	4	Sept. 15	262
Rockfall Nursery Co. (Philip Marotta, Prop.)	Rockfall	70	Aug. 26	210
Rowayton Greenhouses	Rowayton	1	Aug. 31	218
Rushworth, Edwin	Yalesville	1	Aug. 21	198
Russell, C. B.	Newington	1	Sept. 4	239
Saxe & Floto	Waterbury	2	Nov. 16	306
Schaeffer Bros. Nursery	Ledyard	3	Aug. 21	195
Scheepers, Inc., John	Stamford	15	Aug. 11	177
Schulze, Charles T.	Bethel	1	Nov. 15	305
Scott's Nurseries	Hartford	5	Dec. 11	317
Sierman, C. H.	Hartford	8	Sept. 20	274
Simonson, H. C. (2)	Plainville	2	Sept. 3	230
Snelgrove, S. J. (2)	Windsor	1	Sept. 3	231
Sniffin, Charles R. (2)	Granby	12	Aug. 27	213
South Wilton Nurseries (J. C. Van Heiningen, Prop.) ...	South Wilton	3	Aug. 19	184
Southport Nursery (L. Coari, Prop.)	Southport	15	Aug. 25	209
State Forest Nursery (A. F. Hawes, State Forester) ..	Simsbury	3	Sept. 4	237
State Street Nursery (John Natyzon, Mgr.)	New Haven	2	Sept. 17	269
Steck, Charles A.	Newtown	6	Oct. 20	293
Steck, Charles A., Jr.	Bethel	5	Dec. 23	320
Steck, Harold W.	Farmington	10	Dec. 8	315
Steck, Mrs. Sarah B.	Bethel	1	Dec. 23	321
Stratfield Nurseries (George R. Godfrey, Prop.)	Bridgeport	20	Dec. 13	318
Stratford Florist Co. (C. A. Cooper, Prop.)	Stratford	1	Sept. 10	252

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	2	Sept. 3	227
Szirbik & Co., George	New Haven	1	Dec. 10	316
Tanner's Nursery Co.	Burnside	5	Sept. 14	258
Thomas, D. W., 2d	Hamden	1	Aug. 27	214
Upson, R. E.	Marion	4	Sept. 18	270
Van Wilgen Nurseries	Branford	8	Nov. 6	301
Vanderbrook & Son, Charles L.	Manchester	17	Aug. 6	171
Vasileff, Nicholas	Greenwich	2	Sept. 11	256
Verkade's Nurseries	New London and Chesterfield	15	Aug. 11	176
Wallace Nursery	Wallingford	8	Sept. 15	265
Wayside Farm Gardens (Miss I. E. Aldrich, Prop.)	Thomaston	2	Aug. 21	190
Wegner, Conrad F.	Noroton Heights	1	Dec. 28	322
Wheeler, Charles B.	North Stonington	1	Sept. 8	248
Wild, Henry	Greenwich and Norwalk	26	Aug. 20	189
Wilson & Co., C. E.	Manchester	75	Aug. 11	175
Woodruff, C. V.	Orange	1	Oct. 2	284
Wyllie, David (2)	Whitneyville	1	Oct. 6	288
Yale University Landscape Department (G. A. Cromie)	New Haven	3	Oct. 18	289
Yale University School of Forestry	New Haven	2	Oct. 18	290
Zack Co., H. J.	Deep River	5	Aug. 12	179

Total 162 nurseries .... 2,106 acres

Bulletin of Immediate Information No. 57, on "Regulations Concerning the Transportation of Nursery Stock in the United States and Canada," was published in November and sent to all nursery firms on the preceding list. It gives a résumé of all Federal quarantines and of the requirements of each state concerning the shipping of nursery stock.

Inspection of Raspberry Plantations

Several raspberry growers and nurserymen applied for the special inspection and certificate in order to be able to sell plants free from mosaic. This inspection and certificate is necessary to meet the requirements of the states of Michigan, Minnesota, New York and Vermont. Consequently two inspections of each of three plantations were made by both entomologists and botanists. These were mostly in nurseries and some of them contained too much mosaic to warrant certification, but special certificates were granted to three firms on varieties as follows:

Special Certificates on Raspberry Plants

Name of Firm	Address	Variety	Date of issue	Certificate Number
Barnes Nursery & Orchard Co.	Wallingford	Erskine Park, Plum Farmer	Sept. 17	13
Burr & Co., C. R.	Manchester	Columbian, Cumberland, Cuthbert, Golden Queen, Marlboro, Ohio	Sept. 17	14
Conine Nursery Co.	Stratford	Columbian, Cuthbert, La France, Latham	Sept. 17	12

Nursery Dealers

According to Chapter 265, Public Acts of 1925, dealers in nursery stock must also register with the State Entomologist, giving the chief sources of their nursery stock. During the calendar year, 94 dealers were registered and permits granted. These dealers' permits were issued only for the remainder of the current year and all expired on December 31. The list of dealers is not printed in this Report.

Out-of-State Nurserymen

Nurserymen in other states desiring to ship nursery stock into Connecticut are required to file copies of their inspection certificates and make application for permits to ship stock into the State. Such permits are valid only for the period covered by the certificates placed on file. During the year 181 permits have been issued to nurserymen in other states, but the list of nurserymen receiving them is not included in this report.

INSPECTION OF IMPORTED NURSERY STOCK

W. E. Britton and M. P. Zappe

During the past seven years the nursery stock entering Connecticut from foreign countries has been entirely fruit and rose seedlings for propagation. As in preceding seasons, this stock has been inspected mostly by Mr. Zappe, though he has been assisted in certain instances by Messrs. B. H. Walden and J. L. Rogers. The number of plants was greater than in 1925 and has been exceeded only in 1924, as the following table giving the statistics for the past seven years will show:

Year	No. of shipments	No. of cases	No. of plants
1920	17	87	814,491
1921	21	126	1,228,560
1922	30	159	1,997,595
1923	35	179	1,981,895
1924	33	313	3,489,170
1925	27	277	2,977,346
1926	32	347	3,443,357

These 32 shipments were imported by nine different Connecticut firms, 21 shipments being consigned to two firms. Of the total number of shipments, 21 shipments contained only rose stocks, six shipments contained only fruit stocks, and five shipments contained both rose and fruit stocks.

The time required to inspect this stock is equivalent to one man working 36 days, and this time, together with the cost of travel and other necessary expenses, amounts to about $500.00.

Of this plant material inspected, 1,889,507 or about 55 per cent were fruit seedlings, and 1,553,850 or about 45 per cent were rose stocks. The number of each variety is shown in the following table:

KINDS OF STOCKS IMPORTED

Variety	Number of Plants	Total
FRUIT STOCKS		
Apple	860,507	
Apple, dwarf (Doucin)	20,000	
Cherry (Mahaleb)	372,000	
Cherry (Mazzard)	25,000	
Pear	413,000	
Plum (Myrobolan)	185,000	
Quince	14,000	1,889,507
ROSE STOCKS		
Rosa manetti	1,279,050	
Rosa multiflora japonica	24,000	
Rosa rugosa	255,800	1,553,850
		3,443,357

Though the greatest number of shipments came from Holland, the greatest number of cases and plants came from France, as the following table will show:

SOURCES OF IMPORTED NURSERY STOCK, 1925-1926

Country	No. shipments	No. cases	No. plants
France	8	193	2,098,400
Holland	19	149	1,326,950
Ireland	2	2	8,000
England	1	1	10,000
Canada	2	2	7
	32	347	3,443,357

The following table shows the quantities of stock as inspected by months:

Month	No. shipments	No. cases	No. plants
November	1	2	15,000
December	6	35	303,000
January	8	108	919,400
February	8	161	1,859,000
March	2	4	41,900
April	3	21	160,050
May	4	16	145,007
	32	347	3,443,357

In addition to the material enumerated and tabulated above, there was one shipment of seven cases which was probably received and unpacked through a mistake, though the number of plants was not given, and 25 shipments containing 32 packages of seeds, mostly of trees and palms, which were not inspected in Connecticut.

Of the 32 shipments inspected, 13 shipments, or about 40 per cent, were found infested with insects or plant diseases, some of which are well-known pests. Details regarding these pests are given below.

Pests Found on Imported Nursery Stock

13 Shipments Infested

INSECTS

Acronycta sp. on apple (1 shipment). Andre Choplin, Angers, France.

Acronycta rumicis on pear (1 shipment). Andre Choplin, Angers, France.

Emphytus cinctus Linn. on rose (9 shipments). Felix & Dykhuis, Boskoop, Holland; A. Fermaud, Franco-American Seedling Co., Angers, France; Oudyk Bros., Boskoop, Holland; Fa. As. Ouwerkerk, Boskoop, Holland; Aug. Rolker & Sons, Veendam, Holland.

Euproctis chrysorrhoea Linn. egg mass on pear (1 shipment). A. Fermaud, Franco-American Seedling Company, Angers, France.

Notolophus antiqua Linn. (3 shipments) 2 on rose, 1 on apple. Andre Choplin, Maze, France; (egg mass) A. Fermaud, Franco-American Seedling Co., Angers, France; C. Klijn & Co., Boskoop, Holland.

Rhabdophaga salicis Schrank galls on tying willows (1 shipment). Oudyk Bros., Boskoop, Holland.

Rose scale on manetti (1 shipment). A. Fermaud, Franco-American Seedling Co., Angers, France.

Woolly aphis on apple (2 shipments). Andre Choplin, Maze, France; A. Fermaud, Franco-American Seedling Co., Angers, France.

PLANT DISEASES

Crown gall on pear (1 shipment). A. Fermaud, Franco-American Seedling Co., Angers, France.

INSPECTION OF APIARIES IN 1926

In 1926, as for several years past, the apiary inspection work has been done by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, on a *per diem* basis. Mr. Coley covers the southern half of the State (Fairfield, New Haven, Middlesex, and New London Counties), and Mr. Yates the northern half (Litchfield, Hartford, Tolland, and Windham Counties).

This work required a total of 194 man days and the entire cost for the season of 1926 was $1,918.35. In all, 814 apiaries, containing 7,923 colonies, were inspected in 1926 as against 766 apiaries containing 8,257 colonies in 1925. The apiaries averaged 9.7 colonies each in 1926, and 10.7 each in 1925.

The following table shows the number of apiaries and colonies inspected and the average number of colonies per apiary, as well as the cost per apiary and colony for each year since the inspection work was commenced in 1910:

SEVENTEEN-YEAR RECORD OF APIARY INSPECTION IN CONNECTICUT

Year	No. of Apiaries	No. of Colonies	Average No. Colonies Per Apiary	Average Cost of Inspection Per Apiary	Per Colony
1910	208	1,595	7.6	$2.40	.28
1911	162	1,571	9.7	1.99	.21
1912	153	1,431	9.3	1.96	.21
1913	189	1,500	7.9	1.63	.21
1914	463	3,882	8.38	1.62	.19
1915	494	4,241	8.58	1.51	.175
1916	467	3,898	8.34	1.61	.19
1917	473	4,506	9.52	1.58	.166
1918	395	3,047	7.8	1.97	.25
1919	723	6,070	11.2	2.45	.29
1920	762	4,797	6.5	2.565	.41
1921	751	6,972	9.2	2.638	.24
1922	797	8,007	10.04	2.60	.257
1923	725	6,802	9.38	2.55	.27
1924	953	8,929	9.4	2.42	.25
1925	766	8,257	10.7	2.45	.22
1926	814	7,923	9.7	2.35	.24

In 1926, apiaries were inspected in 137 towns, as against 118 towns in 1925, and 149 towns in 1924.

Inspections were made in the following 30 towns in 1926 which were not visited in 1925: Fairfield County—Brookfield, Fairfield, Newtown; New Haven County—East Haven, Middlebury, North Branford, Orange; Middlesex County—Middlefield; New London County—Ledyard, North Stonington; Litchfield County—Bridgewater, Kent, New Milford, Roxbury, Washington, Woodbury; Hartford County—Enfield, New Britain, Plainville, Southington; Tolland County—Bolton, Ellington, Somers, Stafford,

Tolland, Union, Vernon, Willington; Windham County—Ashford, Pomfret.

On the other hand, the following 12 towns, where inspections were made in 1925, were not visited by the inspectors in 1926: Shelton in Fairfield County; Cheshire and Seymour in New Haven County; Essex and Saybrook in Middlesex County; Plymouth in Litchfield County; Marlborough, South Windsor and Windsor Locks in Hartford County; Hebron in Tolland County; Chaplin and Thompson in Windham County.

European Foul Brood

This bacterial disease of the young larvae caused by *Bacillus pluton* is known as European foul brood, and is more troublesome in spring and early summer than at other periods of the year. Usually the cell contents are not ropy or gelatinous, and though often with the odor of fermentation, it is not very offensive. The common treatment is to requeen the diseased colonies with Italian queens, and to unite two or more weak colonies in order to make them all as strong as possible.

Of the 814 apiaries and 7,923 colonies inspected in 1926, 26 apiaries and 68 colonies were found infested with European foul brood. This is 3.19 per cent of the apiaries and .858 per cent of the whole number of colonies inspected during the season—a somewhat larger percentage of both apiaries and colonies than has been found diseased with European foul brood since 1922.

The following table shows the records regarding European foul brood in Connecticut since the inspection work began in 1910:

RECORD OF EUROPEAN FOUL BROOD

Year	Percentage of Infestation		Year	Percentage of Infestation	
	Apiaries	Colonies		Apiaries	Colonies
1910	75.9	49.7	1919	6.6	1.2
1911	51.8	27.4	1920	4.3	1.5
1912	47.7	23.5	1921	3.91	1.26
1913	44.4	24.5	1922	4.14	.85
1914	32.6	13.9	1923	2.34	.36
1915	26.1	10.3	1924	1.78	.526
1916	18.8	7.05	1925	2.48	.507
1917	16.7	4.86	1926	3.19	.858
1918	9.8	3.3			

During 1926, European foul brood was found only in the following towns: Naugatuck in New Haven County; North Stonington in New London County; Brooklyn, Killingly, Plainfield and Putnam in Windham County; Coventry in Tolland County; Canton and New Britain in Hartford County; Harwinton, Kent, Roxbury, Thomaston and Winchester in Litchfield County. None was found in Fairfield or Middlesex Counties, as was the case in 1925.

American Foul Brood

This is also a bacterial disease of the larvae, and is caused by *Bacillus larvae,* but it attacks the brood at a later stage of its development than does the disease called European foul brood. It usually shows when the larvae are mature and pupating after the cells are sealed. The diseased cells are shrunken, and if broken open, the contents have a peculiar ropy or stringy consistency and give off a very offensive odor. The treatment has been to shake the colonies into clean hives, destroy the infected combs, and disinfect the old hives. Now it is feasible to sterilize the diseased combs by soaking them in an alcohol-formalin solution containing 20 per cent of formalin, after which they may safely be used.

Of the 814 apiaries and 7,923 colonies inspected in 1926, 14 apiaries and 23 colonies were found diseased with American foul brood. This is 1.72 per cent of the apiaries and .29 per cent of the whole number of colonies inspected in 1926. This is a smaller percentage of both apiaries and colonies than was found in 1925.

The following table gives a complete record regarding American foul brood since apiary inspection was initiated in Connecticut in 1910:

RECORD OF AMERICAN FOUL BROOD

Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies	Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies
1910	0	0	1919	3.	1.1
1911	0	0	1920	1.18	.25
1912	0	0	1921	2.5	.56
1913	0	0	1922	1.38	.27
1914	1.07	.7	1923	.965	.323
1915	.8	.18	1924	1.04	.22
1916	1.07	.15	1925	3.26	.424
1917	.42	.17	1926	1.72	.29
1918	1.01	.32			

During 1926, American foul brood was found in the following towns: Greenwich and Stamford in Fairfield County; Madison and Middlebury in New Haven County; Bozrah, Ledyard and Norwich in New London County; Litchfield and Watertown in Litchfield County; Suffield in Hartford County; Andover in Tolland County.

Sacbrood

Sacbrood or pickled brood is a disease often mistaken for American or European foul brood. The cause is considered to be a filterable virus. The larvae die about the time the cells are capped and lie on their backs with heads turned upward. The body is swollen and contents watery, but there is no ropiness, and the entire cell contents may easily be removed intact as if enclosed

in a sac. The color is variable, though often light yellow or brown, with head nearly black. The usual treatment is to make strong colonies by uniting the weak ones. In certain rare cases where whole apiaries become infected, new queens should be supplied to all the colonies.

The following table shows the record of sacbrood since apiary inspection in Connecticut started in 1910:

RECORD OF SACBROOD

Year	Percentage of Infestation Apiaries	Colonies	Year	Percentage of Infestation Apiaries	Colonies
1910	0	0	1919	1.24	.19
1911	..	.51	1920	1.18	.229
1912	..	Several	1921	1.06	.157
1913	..	2.8	1922	1.37	.187
1914	2.59	.721	1923	.53	.086
1915	2.02	.47	1924	1.78	.52
1916	.428	.051	1925	3.39	.836
1917	1.48	.199	1926	1.1	.138
1918	.253	.032			

STATISTICS OF INSPECTION

The statistics of apiary inspection by towns and counties may be found in the following pages, with summary on page 198:

INSPECTION OF APIARIES, 1926

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
Fairfield County:							
Bethel	6	1	63	1	0	0	1
Brookfield	2	0	68	0	0	0	0
Danbury	5	0	80	0	0	0	0
Darien	4	0	49	0	0	0	0
Easton	4	0	99	0	0	0	0
Fairfield	6	0	93	0	0	0	0
Greenwich	14	1	128	1	1	0	0
New Canaan	6	1	76	1	0	0	1
Newtown	5	0	112	0	0	0	0
Norwalk	7	1	91	1	0	0	1
Redding	2	0	8	0	0	0	0
Ridgefield	6	0	61	0	0	0	0
Stamford	15	1	201	1	1	0	0
Westport	1	0	8	0	0	0	0
Wilton	8	0	170	0	0	0	0
	91	5	1,307	5	2	0	3
New Haven County:							
Beacon Falls	2	0	52	0	0	0	0
Branford	3	0	25	0	0	0	0
Derby	3	0	17	0	0	0	0
East Haven	2	0	13	0	0	0	0
Guilford	2	0	23	0	0	0	0
Madison	2	1	26	3	3	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
New Haven County—*cont.*							
Meriden	7	0	137	0	0	0	0
Middlebury	3	1	31	1	1	0	0
Naugatuck	4	1	45	2	0	2	0
North Branford	1	0	26	0	0	0	0
North Haven	5	1	43	2	0	0	2
Orange	2	0	8	0	0	0	0
Prospect	5	1	35	1	0	0	1
Wallingford	14	1	101	1	0	0	1
Waterbury	4	0	28	0	0	0	0
	59	6	610	10	4	2	4
Middlesex County:							
Chester	4	0	39	0	0	0	0
Clinton	4	1	60	2	0	0	2
Cromwell	3	0	22	0	0	0	0
Durham	5	0	103	0	0	0	0
East Haddam	7	0	230	0	0	0	0
East Hampton	12	0	167	0	0	0	0
Haddam	3	0	67	0	0	0	0
Killingworth	2	0	9	0	0	0	0
Middlefield	3	0	58	0	0	0	0
Middletown	5	0	61	0	0	0	0
Old Saybrook	2	0	20	0	0	0	0
Portland	5	0	35	0	0	0	0
Westbrook	2	1	4	1	0	0	1
	57	2	875	3	0	0	3
New London County:							
Bozrah	3	2	109	4	3	0	1
Colchester	6	0	44	0	0	0	0
East Lyme	2	0	55	0	0	0	0
Franklin	1	0	24	0	0	0	0
Griswold	4	0	92	0	0	0	0
Groton	4	0	48	0	0	0	0
Lebanon	10	0	129	0	0	0	0
Ledyard	3	1	30	1	1	0	0
Lisbon	2	0	30	0	0	0	0
Lyme	1	0	42	0	0	0	0
Montville	3	0	29	0	0	0	0
North Stonington	4	1	47	1	0	1	0
Norwich	11	1	464	1	1	0	0
Old Lyme	4	0	67	0	0	0	0
Preston	2	0	22	0	0	0	0
Salem	2	0	24	0	0	0	0
Sprague	1	0	12	0	0	0	0
Stonington	5	0	58	0	0	0	0
Voluntown	2	0	15	0	0	0	0
Waterford	2	0	52	0	0	0	0
	72	5	1,393	7	5	1	1
Litchfield County:							
Barkhamsted	3	1	22	1	1	0	0
Bethlehem	10	0	33	0	0	0	0
Bridgewater	5	0	92	0	0	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
Litchfield County—*cont.*							
Canaan	1	0	6	0	0	0	0
Colebrook	6	0	35	0	0	0	0
Cornwall	11	0	76	0	0	0	0
Goshen	5	0	41	0	0	0	0
Harwinton	6	2	25	4	0	4	0
Kent	6	1	57	4	0	4	0
Litchfield	14	2	172	6	6	0	0
Morris	5	0	12	0	0	0	0
New Hartford..	5	0	20	0	0	0	0
New Milford ..	14	0	121	0	0	0	0
Norfolk	2	0	11	0	0	0	0
North Canaan..	2	0	61	0	0	0	0
Roxbury	3	1	16	1	0	1	0
Salisbury	6	0	24	0	0	0	0
Sharon	5	0	87	0	0	0	0
Thomaston	2	1	14	1	0	1	0
Torrington	9	0	85	0	0	0	0
Washington ...	8	0	137	0	0	0	0
Watertown	14	1	47	1	1	0	0
Winchester	8	1	52	1	0	1	0
Woodbury	6	0	76	0	0	0	0
	156	10	1,322	19	8	11	0
Hartford County:							
Avon	3	0	22	0	0	0	0
Berlin	10	0	153	0	0	0	0
Bloomfield	2	0	45	0	0	0	0
Bristol	14	0	75	0	0	0	0
Burlington	6	0	25	0	0	0	0
Canton	12	1	56	2	0	2	0
East Granby ...	5	0	25	0	0	0	0
East Hartford..	6	0	33	0	0	0	0
East Windsor ..	6	0	12	0	0	0	0
Enfield	8	0	45	0	0	0	0
Farmington ...	12	0	41	0	0	0	0
Glastonbury ...	16	0	152	0	0	0	0
Granby	5	0	58	0	0	0	0
Hartford	5	0	24	0	0	0	0
Hartland	2	0	28	0	0	0	0
Manchester ...	12	0	84	0	0	0	0
New Britain ..	13	2	103	7	0	7	0
Newington	9	0	47	0	0	0	0
Plainville	3	0	12	0	0	0	0
Rocky Hill	6	0	38	0	0	0	0
Simsbury	6	0	40	0	0	0	0
Southington ...	14	0	46	0	0	0	0
Suffield	14	1	80	3	3	0	0
West Hartford	8	0	84	0	0	0	0
Wethersfield ..	5	0	30	0	0	0	0
Windsor	11	0	58	0	0	0	0
	213	4	1,416	12	3	9	0
Tolland County:							
Andover	4	1	17	1	1	0	0
Bolton	1	0	6	0	0	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
Tolland County—*cont.*							
Columbia	3	0	16	0	0	0	0
Coventry	16	1	98	2	0	2	0
Ellington	10	0	35	0	0	0	0
Mansfield	4	0	31	0	0	0	0
Somers	3	0	6	0	0	0	0
Stafford	13	0	29	0	0	0	0
Tolland	4	0	38	0	0	0	0
Union	3	0	8	0	0	0	0
Vernon	6	2	39	2	0	2	0
Willington	14	0	56	0	0	0	0
	81	4	379	5	1	4	0
Windham County:							
Ashford	2	0	13	0	0	0	0
Brooklyn	2	1	134	10	0	10	0
Canterbury	6	0	41	0	0	0	0
Hampton	3	0	55	0	0	0	0
Killingly	12	2	55	2	0	2	0
Plainfield	22	7	100	18	0	18	0
Pomfret	9	0	55	0	0	0	0
Putnam	5	2	39	11	0	11	0
Scotland	6	0	24	0	0	0	0
Sterling	6	0	17	0	0	0	0
Windham	8	0	57	0	0	0	0
Woodstock	4	0	31	0	0	0	0
	85	12	621	41	0	41	0

SUMMARY

County	No. Towns	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
Fairfield ...	15	91	5	1,307	5	2	0	3
New Haven	15	59	6	610	10	4	2	4
Middlesex ..	13	57	2	875	3	0	0	3
New London	20	72	5	1,393	7	5	1	1
Litchfield ..	24	156	10	1,322	19	8	11	0
Hartford ..	26	213	4	1,416	12	3	9	0
Tolland	12	81	4	379	5	1	4	0
Windham ..	12	85	12	621	41	0	41	0
	137	814	48	7,923	102	23	68	11

	No. Apiaries	No. Colonies
Inspected	814	7,923
Infested with European foul brood	26	68
Per cent infested	3.19	.858
Infested with American foul brood	14	23
Per cent infested	1.72	.29
Infested with sacbrood	9	11
Average number of colonies per apiary ...		9.73
Cost of inspection		$1,918.35
Average cost per apiary		2.35
Average cost per colony		.24

GIPSY MOTH WORK IN CONNECTICUT IN 1926

BY W. E. BRITTON AND JOHN T. ASHWORTH

The work has been continued in about the same manner as during the past few years, and is carried on co-operatively—by the State and the Federal Bureau of Entomology. As in former years the Federal forces, being interested particularly in preventing the further spread of the pest, have taken over the scouting of the territory along the boundary of the infested area, and the State forces, for the most part, have worked back from the margin in the territory known to be infested. We here express our thanks and appreciation to Messrs. A. F. Burgess and H. L. Blaisdell, in charge of Federal gipsy moth work, in acknowledgment of many courtesies and of their hearty co-operation.

Perhaps the outstanding features of the work during the season were the discovery of an infestation in Greenwich, near the boundary of New York State, and of another rather large one in Woodstock, both of which it is believed can be handled without unusual difficulty.

PRESENT EQUIPMENT

At present the force consists of 48 men, eleven of whom are rated as foremen, and work as eight scouting crews. The work is supervised by Messrs. Ashworth and McEvoy. During the season for spraying, in May and June, as many men as are needed are detailed to operate the spray outfits.

The present motor vehicle equipment consists of one Buick six-cylinder touring car, one Dodge four-cylinder touring car, eight Ford light delivery trucks, and two Netco trucks fitted with Fitzhenry-Guptill power sprayer outfits.

A horse-drawn power sprayer purchased many years ago is still available for use if needed. About 3,150 feet of one-inch high-pressure spray hose and 150 feet of suction hose are also on hand.

The storehouse rented on North Main Street, Danielson, is fitted with rented gasoline tank and pump, and is well equipped with small tools, Ford parts, tires and tubes, so that most of the repair work can be done by our own men.

FINANCIAL STATEMENT

RECEIPTS

Appropriation for biennial period ending June 30, 1927 .... $100,000.00

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1926

Salaries and Wages	$45,868.97
Printing and Illustrations	70.44
Postage	21.26

Stationery and Office Supplies	$ 41.01	
Telegraph and Telephone	91.15	
Insurance	805.80	
Spraying Supplies	58.78	
Machinery, Tools and Supplies	227.44	
Express, Freight and Cartage	5.56	
Automobiles: Rental and Storage	586.80	
Repairs and Supplies	4,711.38	
Traveling Expenses	377.36	
Heat and Light	183.94	
Inspection of Imported Nursery Stock	54.32	
Miscellaneous	21.35	
		$53,125.56
Balance		46,874.44
		$100,000.00

Details of Work by Counties and Towns

The following pages give a detailed account of the scouting, spraying, and other control measures in towns. All egg-clusters found were treated with creosote to prevent hatching. The statistics are given in the tables beginning on page 212 and are summarized on page 215.

WINDHAM COUNTY

All the work in Windham County this year was done by men being trained, and both State and Federal men were taught different phases of the work in the towns named below. Conditions as to degree of infestation were found to be about the same as in the previous two or three years; it will be noted that in other years this section of the State has been the most heavily infested. Following is a detailed report of the work done in the towns of Windham County:

Brooklyn—11 Infestations—943 Egg-clusters

From the large number of egg-clusters found, Brooklyn would seem to be badly infested, but of this total, 790 egg-clusters were in two colonies. The largest one was in oak and birch growth on land owned by B. Marott, on the south slope of Allen Hill, where 700 egg-clusters were found; the other colony of 90 egg-clusters was on a maple tree on land owned by Edward Caffery, on the west side of Church Street. The other colonies were all small and not considered dangerous. The scouting in this town was done by Federal men, and the spraying by State men, nine of the eleven colonies being sprayed.

Eastford—59 Infestations—1,407 Egg-clusters

Eastford was one of the towns used for training men and was only about two-thirds covered, the work being confined to the northern portion of the town or the territory north of Phoenix-

ville. Three colonies were discovered, each of which contained more than 100 egg-clusters, but all were small in area. The largest had 194 egg-clusters, and was on an oak tree on land owned by J. B. Tatum, just north of the Eastford Post Office; another of 117 egg-clusters was on apple and elm trees owned by Mrs. Andert, about one mile east of the Cemetery. The third colony contained 113 egg-clusters, and was on four oaks owned by Mr. King on the same road and one-fourth of a mile farther east than the colony last mentioned. Twenty-nine of the infestations were sprayed during the summer by State men.

Hampton—6 Infestations—437 Egg-clusters

About thirty-four miles of roadside work were covered in the town of Hampton by State men being trained for this work. Two large colonies were discovered, one of 317 egg-clusters in woodland owned by Messrs. Smith and Stahkne, in the southeast corner of the town near the Canterbury line, and the other in apple trees in pasture owned by Mr. McLaughlin, in the south-central part of the town, near the Scotland line. The other four colonies were small, twenty egg-clusters being the largest, on fifteen white oaks owned by J. L. Goodwin, on the western border of the town just north of the State road. Three of the six colonies were found close together in this vicinity. Two of the six were sprayed by State men.

Killingly—56 Infestations—3,856 Egg-clusters

Killingly was used as a training school by Federal men, and several large colonies were discovered while scouting the town. At two of the places over 300 egg-clusters each were found, both colonies being on oak trees. The largest was on property owned by Mrs. Kanes, in the Goodyear district, where 350 egg-clusters were found and treated. The other colony was on land owned by Mr. Clark in South Killingly, containing 347 egg-clusters. The next largest was a colony of 217 egg-clusters scattered in woodland owned by A. A. Tillinghast, in the southeast corner of the town near what is known as the "Line Store" district; another colony of 167 egg-clusters was found on oak trees and in a stone wall on property owned by William Davis, near the "Old Furnace." These colonies were the largest, but several other colonies were found, ranging from thirty-five to fifty egg-clusters each, and scattered through all parts of the town. Thirty-five of the worst colonies were sprayed with arsenate of lead by State men.

Plainfield—6 Infestations—653 Egg-clusters

In scouting Plainfield, Federal men discovered two large colonies; one of 312 egg-clusters on oaks in a pasture owned by H. B. Brown, on the west slope of "Black Hill" near the Canterbury line, and the other in "Ekonk Hill" district, where 120 egg-clusters were found. All six of the colonies were in the southern half of the town. Several single egg-clusters were discovered in the northern half of the town, but no colonies. Four of the six colonies were sprayed by State men.

Putnam—30 Infestations—863 Egg-clusters

One colony of 144 egg-clusters and one of 78 egg-clusters were the two largest colonies found in Putnam. Both were on oaks, near the Windham County Children's Home. That of 144 egg-clusters was on land owned by A. Paquin, and that of 78 egg-clusters was on the property of the Home. A colony of 48 egg-clusters was found in oaks owned by A. Tourtellotte on Putnam Heights, and another colony of 48 egg-clusters was found in an oak grove, on the state road leading to Mechanicsville. Scouting in the town was done by Federal men. Twenty-six colonies were sprayed by the State crews.

Thompson—100 Infestations—7,158 Egg-clusters

Thompson was also used as a school for training men, by the Federal force. Two exceptionally large colonies in woodland were discovered. One containing 1,600 egg-clusters was found on property owned by W. Cassidy near Fabyan village. The other was in woodland owned by the Grosvenordale Company in North Grosvenordale, where 1,500 egg-clusters were found. Several colonies containing about 100 egg-clusters each were discovered. Two colonies of 200 egg-clusters each, and one of 225 egg-clusters were also found, all in oak woodland. Both of the 200 egg-cluster colonies were located in North Grosvenordale, one on land owned by Mr. Keegan, the other on land owned by the Grosvenordale Company. The 225 egg-cluster colony was on land owned by C. Cassidy near Fabyan. Thompson continues to be the most heavily infested town in the State, but it is very gratifying to know that the Tachinid parasites have become established and their work was noted this year. In the summer, spraying was done at 72 infestations by State men.

Woodstock—24 Infestations—5,848 Egg-clusters

In scouting Woodstock, Federal men discovered a colony of 5,000 egg-clusters in willow trees, on land owned by Messrs. Lowe and Ericson, at the south end of Roseland Pond. This was the

largest colony found in the state this year, though it was in low land and can be easily handled. Another colony of 200 egg-clusters was found in oaks in a pasture, about one mile north of the colony just mentioned. The next largest colony contained 150 egg-clusters on a pasture oak, on land owned by John Clark, about one mile northwest of the two colonies mentioned above. These three colonies were the only ones found in Woodstock which we consider of sufficient importance to mention in this report. Seventeen of the 24 colonies were sprayed by State men.

NEW LONDON COUNTY

All work done in New London County this year was done by State crews, but when this territory was reached it was so late in the season that scouting in some of the towns was not completed until larvae were hatched and crawling. In Groton, Norwich, Old Lyme, and Waterford, scouting was carried on throughout the summer. The following is a summary of the work in this County:

Colchester—2 Infestations—266 Egg-clusters

The work done in Colchester consisted of scouting around last year's infestations. Two places were reinfested. At the woodland colony owned by Edwin Brown, in the south-central part of the town, 256 egg-clusters were found, and 10 egg-clusters at Nicholas Clement's place, in the extreme southeastern corner of the town. Both colonies were sprayed about the middle of June, nearly 17 acres of woodland being treated.

Franklin

The work in Franklin this year, as in Colchester, consisted merely in scouting around the old infestations. About five miles of roadside work were covered but no infestations found.

Groton—9 Infestations—363 Egg-clusters

State men scouted Groton this year during the late spring and early summer. Four moderate-sized colonies were found. One of 123 egg-clusters was on roadside trees on property owned by W. T. Whyman, G. S. Avery, and the Spicer Coal and Ice Company in Groton village; another of 68 egg-clusters was found on apple and cherry trees owned by Mrs. Wagner and B. Porter in West Mystic. The third colony of 65 egg-clusters was on apple trees and in a stone wall on property owned by H. E. Bentley, in Noank village. The fourth colony of 50 egg-clusters was on apple and maple trees owned by the Sea Sled Company in West Mystic. The other five colonies were all small. Three of these places were sprayed in the summer by State men.

Ledyard—1 Infestation—6 Egg-clusters

Through a lucky accident, an infestation of six egg-clusters was discovered in the town of Ledyard this year. One of the men in the crew scouting in Groton wandered over the line into Ledyard and found this colony, which was sprayed on June 28.

Norwich—2 Infestations—20 Egg-clusters

Scouting was carried on in Norwich throughout the summer months, and two infestations were found. One of 19 egg-clusters was on willow trees owned by the New England Metal Company on Shipping Street. The other was a single egg-cluster, found on a maple in a yard owned by Thomas Heetman, near the Bozrah town line. The colony first mentioned was sprayed on the 26th and 28th of June.

Old Lyme

About one-third of the town was scouted and, no trace of the gipsy moth being found, the crew was then transferred to other work in the northeastern corner of the State.

Waterford

About three-quarters of the town of Waterford was scouted during the late spring and early summer. One single egg-cluster was found in an orchard along the north side of the New London-New Haven State road, just east of Jordan Brook. This crew was moved on July 15th, to take up other work in the northeastern corner of the State.

TOLLAND COUNTY

The same methods were used in Tolland County as in New London County; that is, scouting was confined to the areas around last year's infestations. This was necessary on account of the lateness in the season and the lack of men and money when this territory was reached. Nothing was found in Andover, Bolton, Coventry, Hebron, and Vernon. Other towns where scouting was done and gipsy moth colonies were found are as follows:

Columbia—3 Infestations—920 Egg-clusters

Three colonies were found in Columbia, all within an area of approximately one-half square mile. Two were on land owned by D. Topple, one in a stone wall and woodland containing 210 egg-clusters, and another of 35 egg-clusters in an old rail fence and mixed woodland. The third and largest colony was found in apple trees and a stone wall on land owned by Jake Ketsewitz,

where 675 egg-clusters were creosoted. These colonies were situated in the southwestern part of the town, and all three colonies were sprayed by State men.

Ellington—5 Infestations—25 Egg-clusters

Five small infestations were found in Ellington, the largest containing 21 egg-clusters. This colony was in white oaks in a pasture owned by Frank Gordiza, near the Somers' town line. All the other infestations were single egg-clusters. Spraying was not thought necessary.

Stafford—10 Infestations—228 Egg-clusters

Stafford was used by the Federal men as a training school and about one-half of the town was scouted. Ten colonies were found, the largest containing 81 egg-clusters, in pasture oaks owned by N. Cumber, about halfway between Orcuttville and Stafford Post Office. Another colony of 37 egg-clusters was found in an oak woodland border owned by J. Michlec, in the southeastern corner of the town near the Union and Willington town lines. The next largest colony was one of 22 egg-clusters in an orchard owned by J. Waytas, in the northeast corner of the town near the Massachusetts line. The other colonies were small. Seven of the ten colonies were sprayed by State men.

Tolland—1 Infestation—5 Egg-clusters

One colony of five egg-clusters was discovered on white oak trees on land owned by John E. Klough, near the center of the town. This colony was sprayed by State men.

HARTFORD COUNTY

Work was done in 25 of the 29 towns in Hartford County this year. Following is a summary of the work done in the towns:

Avon

Avon was scouted by State men but no trace of the gipsy moth found.

Bloomfield—2 Infestations—11 Egg-clusters

Two small infestations were discovered by State men. One of ten egg-clusters was in a woodland margin owned by George O. Sellew, on the western side of the town, along the State road leading over Simsbury Mountain. The other was a single egg-cluster on oak, on land owned by J. G. Hawley, about one-half mile south of Bloomfield depot. About two acres of woodland were sprayed by Federal men at Mr. Sellew's.

Bristol

State men scouted approximately fifty miles of roadway in Bristol, and, finding no trace of the gipsy moth, were transferred on May 15 to territory further east.

Burlington—3 Infestations—52 Egg-clusters

The scouting in Burlington was done by State men and was completed January 12. One colony and two small infestations were found, all three in apple orchards. The colony, containing 49 egg-clusters, was on property owned by Mr. Schuster, situated in the northwestern corner of the town. The other two infestations were small, containing one and three egg-clusters respectively. One hundred and fifty-eight shade and apple trees were sprayed at the colony noted above, by Federal men.

Canton—4 Infestations—1,342 Egg-clusters

In scouting Canton this year, the State men discovered four large colonies, three in woodland, and one in an apple orchard. The three woodland colonies were all situated in the northern end of the town; one of 1,033 egg-clusters on property owned by H. Smith and W. Freytag; one of 150 egg-clusters, owner unknown; and one of 107 egg-clusters on land owned by Arthur Sweeten. The fourth colony was one of 52 egg-clusters in an apple orchard, owned by L. B. Worth, near the center of the town. All four colonies were sprayed by Federal men.

East Granby—3 Infestations—42 Egg-clusters

State men scouted East Granby, the work being completed December 11. Thirty-seven of the 42 egg-clusters were on two willow trees and a fence rail, on property owned by Mr. Viets, about a half-mile east of East Granby Post Office.

East Hartford—3 Infestations—677 Egg-clusters

Three colonies were discovered by State men in East Hartford, all being situated in the southern end of the town. The largest colony was one of 654 egg-clusters, found on apple trees owned by John Penny, near the Glastonbury line. The other two were small colonies, about a mile northeast of the first, on land owned by F. W. Sheafer and H. E. Keeney. All three of these places were sprayed by State men.

East Windsor

The work in East Windsor this year consisted of scouting around the areas where infestations occurred last year. About fifteen miles of roadway were scouted and no infestations found, all work being done by State men.

Farmington—1 Infestation—11 Egg-clusters

A state crew scouted about two-thirds of the town and only one colony was found. This contained 11 egg-clusters and was in woodland owned by Roy Barnes, in the northeast corner of the town. This colony was sprayed by Federal men.

Glastonbury—2 Infestations—2 Egg-clusters

Scouting in Glastonbury was confined to the northern part of the town, in the section near the East Hartford and Manchester town lines. Thirty-eight miles of roadway were scouted and two single egg-cluster infestations were found. No further work was attempted in Glastonbury, as the season of scouting was getting late and the men were needed in other sections of the State.

Granby—20 Infestations—1932 Egg-clusters

In scouting Granby the State men discovered several large colonies this year. Three of them contained more than 300 egg-clusters each. One colony of 446 egg-clusters and another of 397 egg-clusters were in woodland owned by A. Luprun, and one of 378 egg-clusters in woodland and abandoned orchard owned by Max Shinder. All three of these colonies were situated in the extreme southwestern corner of the town. Another colony of 167 egg-clusters was found in woodland owned by A. R. Carpenter, about two miles west of West Granby Post Office. These four colonies were the largest in the town, the others being small—numbering 25 egg-clusters each. Twelve of the worst colonies were sprayed by Federal men, more than a ton and a quarter of lead arsenate being used.

Hartford—8 Infestations—1,151 Egg-clusters

Three large colonies were discovered in the City of Hartford by State men. The largest contained 798 egg-clusters, and was on property owned by A. Mather, on Windsor Avenue; the second, of 171 egg-clusters, was on an apple tree and shed owned by Kagan Brothers, on Windsor Avenue; the third, of 118 egg-clusters, was on poplar trees on Whitney Street. Five other small colonies were discovered and six of the eight infestations were sprayed by Federal men.

Hartland—13 Infestations—360 Egg-clusters

In scouting Hartland, State men discovered 13 infestations distributed over all parts of the town. There were only two colonies of moderate size: one of 120 egg-clusters on old apple trees in woodland owned by William Peck, in the northeast corner of the town, and another of 80 egg-clusters in a stone wall and trees in woodland owned by T. A. Howell, in the northwestern corner of the town. Five infestations were sprayed during the early summer by Federal men.

New Britain—2 Infestations—121 Egg-clusters

Two infestations were found in New Britain by State men. One of 118 egg-clusters was on land owned by the Polish Orphanage, on North Burritt Street, and the other was on apple and cherry trees owned by Messrs. Dynkowski and Bednan, on High Street. Both were sprayed by Federal men.

Simsbury—6 Infestations—166 Egg-clusters

Of the six infestations found by State men, only two of them contained more than ten egg-clusters each. One on oaks, at the Ethel Walker School, contained 112 egg-clusters, and the other on roadside trees on town property near Tariffville Post Office, contained 37 egg-clusters. Both of these colonies were sprayed by Federal men.

Suffield—13 Infestations—122 Egg-clusters

The 13 colonies found by State men were all small, the largest infestation containing 35 egg-clusters. This colony was on five oak trees in a field owned by Henry Sheldon, on the east side of the State road leading from West Suffield to East Granby, near the town line. The next largest was a colony of 19 egg-clusters in a woodland margin owned by Andrew Barrow, about two miles north of West Suffield village. The third largest colony was one of 18 egg-clusters on property owned by Jean Roy, situated about a mile north of West Suffield village. Most of the other infestations found in the town were single egg-clusters. Four infestations were sprayed by Federal men.

West Hartford—3 Infestations—364 Egg-clusters

State men scouted West Hartford this year and found three infestations, with a total of 364 egg-clusters: 361 were found on 11 willow trees owned by Mrs. J. F. Ryan, in the southern end of the town near the Newington line. All three colonies were within an area of half a square mile. The willow trees were all sprayed by Federal men.

Windsor—1 Infestation—2 Egg-clusters

State men discovered one infestation of two egg-clusters in the southern part of the town just north of the Fuller Brush Company's land. No further work was thought necessary at this infestation, as the egg-clusters were not broken, and when creosoted there was no danger of spread.

The work done in Newington, South Windsor and Wethersfield consisted of scouting around infested territory of previous years. Although approximately seventy miles of roadway were covered in these three towns, no trace of the gipsy moth was found. The following towns in Hartford County were completely scouted and no gipsy moth egg-clusters found: Manchester, Plainville, Rocky Hill, and Windsor Locks.

MIDDLESEX COUNTY

The four following towns in Middlesex County were scouted this year by State men and no trace of the gipsy moth was found: Cromwell, Durham, East Hampton and Middlefield.

NEW HAVEN COUNTY

The three towns of Meriden, Waterbury and Wolcott were scouted by State men, and the rest of the work in this County was done by Federal men. In Waterbury no gipsy moth infestations were discovered. Following is a description of the work done in the other two towns:

Meriden—2 Infestations—14 Egg-clusters

Both infestations found in Meriden were on street shade trees, one on East Main Street, containing 13 egg-clusters, and the other on Miller Street, of one egg-cluster; 215 trees were sprayed in the vicinity of East Main Street by Federal men.

Wolcott—3 Infestations—1,016 Egg-clusters

The three infestations found in Wolcott contained 1,016 egg-clusters, one of 997 egg-clusters being found in woodland owned by Thomas Zstko, about a half mile north of Wolcott Post Office; the other two infestations were about a quarter of a mile away. All three places were sprayed by Federal men.

The following towns in New Haven County were scouted by Federal men and no infestations found: Bethany, Cheshire, East Haven, Hamden, Middlebury, Naugatuck, New Haven, Orange, Prospect, Wallingford, and Woodbridge.

LITCHFIELD COUNTY

Seven towns in Litchfield County were found to be infested; five were scouted by State men, the other two by Federal men. The following is a detailed report of the work done in these seven towns:

Barkhamsted—10 Infestations—827 Egg-clusters

State men scouted Barkhamsted and found several large colonies, most of which were in woodland. The largest one contained 441 egg-clusters, in woodland owned by Michael Marek, situated about a mile south of Barkhamsted Post Office; the next largest colony was in woodland owned by Charles LeGeyt, in the north central part of the town near the Hartland line, where 34 egg-clusters were found. A cluster of three colonies was found on land owned by A. Malanchuk, about a mile east of the first colony mentioned, 139 egg-clusters being found on this property. Another colony of 90 egg-clusters was found in woodland about a quarter of a mile east of the last-mentioned colony. The other infestations were all small, 12 egg-clusters being the largest. Owing to bad roads and the distance of the infestations from the road, only five places were sprayed by Federal men. The spraying machines were equipped with about a half-mile of hose, but this was insufficient to reach to the colonies from the nearest point where the truck could be driven.

Colebrook—5 Infestations—28 Egg-clusters

Five small colonies were discovered by State men while scouting Colebrook this year, all of them situated along the western border of the town. One colony of 17 egg-clusters was on land owned by L. J. Phelps, and another of 7 egg-clusters was in woodland owned by G. T. Pentecost. Both of these colonies were sprayed by Federal men.

Harwinton—1 Infestation—414 Egg-clusters

Harwinton was scouted by State men. One infestation of 414 egg-clusters was found in woodland owned by Charles Delay, near Campville Post Office. This colony was sprayed by Federal men in the summer.

New Hartford—2 Infestations—117 Egg-clusters

Two large colonies were discovered by State men while scouting New Hartford this year. One of 66 egg-clusters was in a wood margin on property owned by Fred Weingart, near Bakersville

Post Office, and the other, of 51 egg-clusters, was in woodland owned by M. F. Ganon, in the Nepaug district. Both places were sprayed by Federal men in the summer.

Norfolk—3 Infestations—57 Egg-clusters

Norfolk was scouted by Federal men, and three infestations were found. All three were situated in the northeastern corner of the town and were woodland colonies. The largest, of 34 egg-clusters, was in birch growth, on land owned by Henry Lossin; the next, of 15 egg-clusters, was in birch growth on property owned by Mr. Laitinen; the third and smallest colony contained 8 egg-clusters and was on land owned by the Ansonia Produce Company. Spraying was done at two of these places by Federal men.

North Canaan—1 Infestation—12 Egg-clusters

Only one infestation was found in North Canaan by Federal men this year. This was a reinfestation of the large colony found on property owned by Charles Rosier, situated in the eastern end of the town near the Norfolk line; 12 egg-clusters were found just outside the territory sprayed last year. Six of the 12 egg-clusters were old and it was not thought necessary to do any spraying.

Plymouth—1 Infestation—5 Egg-clusters

The State men, while scouting Plymouth, discovered one small colony of 5 egg-clusters, on white oaks and an old rail fence on land owned by Mrs. Tolles, in the southeastern corner of the town, about one mile from the Wolcott town line. This colony was sprayed by Federal men.

Torrington and Winchester were both scouted by State men and nothing found. The following towns were scouted by Federal men and no infestations found: Bethlehem, Bridgewater, Canaan, Cornwall, Goshen, Kent, Litchfield, Morris, New Milford, Roxbury, Salisbury, Sharon, Warren, Washington, Watertown, and Woodbury.

FAIRFIELD COUNTY

All work in Fairfield County this year was done by Federal men. Ten towns were completely scouted and only one town, Greenwich, was found to be infested.

Greenwich—1 Infestation—328 Egg-clusters

A large colony was found in Greenwich in the extreme southwestern corner, 328 egg-clusters heing found and creosoted. This colony was scattered over quite a large area, extending around the dump in that section of the town. There were several property owners, namely, S. Remella, Jos. Santera, Stewart Smart, Thomas Dopson, Thomas Fox and Bria Recio. A large area around this colony was sprayed in the summer in an endeavor to eradicate this colony this year, as the spread of the gipsy moth to this district is considered unnatural. Probably it was brought here hy artificial means, as it is over fifty miles from the nearest infestation, which is in Wolcott. The accompanying photographs (Plates I and II) show some of the conditions around the Greenwich infestation.

The other nine towns scouted in Fairfield County were: Brookfield, Darien, New Canaan, New Fairfield, Norwalk, Ridgefield, Sherman, Stamford, and Wilton. No traces of the gipsy moth were found in these towns.

Tabulated statistics covering all towns worked during the year are given on the following pages, with a county summary on page 215:

STATISTICS OF INFESTATIONS, 1925-1926

Towns	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Windham County:						
Brooklyn ..G	11	943	9	200	8	73
Eastford ..	59	1,407	29	1,383	0	48
Hampton ..	6	437	2	175	211	34
Killingly ..G	56	3,856	35	626	1,498	94
Plainfield ..G	6	653	4	100	2,052	94
Putnam ...G	30	863	26	534	325	47
Thompson ..G	100	7,158	72	2,047	292	106
Woodstock G	24	5,848	17	586	527	78
	292	21,165	194	5,651	4,913	574
New London County:						
Colchester ...	2	266	2	875	145	5
Franklin	0	0	0	0	0	5
Groton	9	363	3	25	907	60
Ledyard	1	6	1	25	0	1
Norwich	2	20	1	100	84	53
Old Lyme ...	0	0	0	0	0	25
Waterford ..	1	1	0	0	0	69
	15	656	7	1,025	1,136	218

G, work done by Federal men.

Towns	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Tolland County:						
Andover	0	0	0	0	0	6
Bolton	0	0	0	0	0	7
Columbia ...	3	920	3	225	230	2
Coventry	0	0	0	0	0	11
Ellington ...	5	25	0	0	114	29
Hebron	0	0	0	0	0	13
Stafford ...G	10	228	7	273	746	44
Tolland	1	5	1	75	0	17
Vernon	0	0	0	0	0	3
	19	1,178	11	573	1,090	132
Hartford County:						
Avon	0	0	0	0	0	61
Bloomfield ..	2	11	1	150	6	77
Bristol	0	0	0	0	0	50
Burlington ..	3	53	1	250	0	86
Canton	4	1,342	4	725	54	73
East Granby..	3	42	0	0	34	38
East Hartford	3	677	3	225	0	64
East Windsor	0	0	0	0	0	15
Farmington ..	1	11	1	50	0	55
Glastonbury..	2	2	0	0	0	38
Granby	20	1,932	12	2,850	1,106	94
Hartford ...	8	1,151	6	1,512	35	171
Hartland	13	380	5	550	149	66
Manchester ..	0	0	0	0	0	88
New Britain..	2	121	2	125	199	56
Newington ..	0	0	0	0	0	23
Plainville ...	0	0	0	0	0	32
Rocky Hill ..	0	0	0	0	0	32
Simsbury ...	6	166	2	437	3	85
South Windsor	0	0	0	0	0	17
Suffield	13	122	4	150	568	85
West Hartford	3	364	1	225	0	100
Wethersfield..	0	0	0	0	0	28
Windsor	1	2	0	0	0	64
Windsor Locks	0	0	0	0	0	32
	84	6,376	42	7,249	2,154	1,530
Middlesex County:						
Cromwell ...	0	0	0	0	0	54
Durham	0	0	0	0	0	61
East Hampton	0	0	0	0	0	81
Middlefield ..	0	0	0	0	0	54
	0	0	0	0	0	250
New Haven County:						
Bethany ....G	0	0	0	0	0	62
Cheshire ....G	0	0	0	0	0	93
East Haven..G	0	0	0	0	0	40
Hamden ....G	0	0	0	0	0	105
Meriden	2	14	1	275	0	129

G, work done by Federal men.

Towns	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
New Haven County—*cont.*						
Middlebury..G	0	0	0	0	0	61
Naugatuck ..G	0	0	0	0	0	60
New Haven..G	0	0	0	0	0	187
Orange .....G	0	0	0	0	0	51
Prospect ...G	0	0	0	0	0	41
Wallingford G	0	0	0	0	0	136
Waterbury ..	0	0	0	0	0	125
Wolcott	3	1,016	3	275	0	60
Woodbridge G	0	0	0	0	0	54
	5	1,030	4	550	0	1,204
Litchfield County:						
Barkhamsted	10	827	5	1,200	19	99
Bethlehem ..G	0	0	0	0	0	50
Bridgewater G	0	0	0	0	0	50
Canaan .....G	0	0	0	0	0	60
Colebrook ..	5	28	2	200	106	74
Cornwall ...G	0	0	0	0	0	107
Goshen .....G	0	0	0	0	0	99
Harwinton ..	1	414	1	775	0	111
Kent ....G	0	0	0	0	0	92
Litchfield ...G	0	0	0	0	0	140
Morris .....G	0	0	0	0	0	51
New Milford G	0	0	0	0	0	172
New Hartford	2	117	2	200	0	96
Norfolk ....G	3	57	1	50	0	90
North Canaan G	1	6	0	0	0	55
Plymouth ...	1	5	1	100	0	84
Roxbury ...G	0	0	0	0	0	73
Salisbury ...G	0	0	0	0	0	113
Sharon .....G	0	0	0	0	0	143
Torrington ..	0	0	0	0	0	128
Warren ....G	0	0	0	0	0	62
Washington G	0	0	0	0	0	105
Watertown ..G	0	0	0	0	0	87
Winchester ..	0	0	0	0	0	13
Woodbury ..G	0	0	0	0	0	103
	23	1,454	12	2,525	125	2,257
Fairfield County:						
Brookfield ..G	0	0	0	0	0	68
Darien .....G	0	0	0	0	0	49
Greenwich ..G	1	328	1	1,175	0	143
New Canaan G	0	0	0	0	0	71
New Fairfield G	0	0	0	0	0	52
Norwalk ...G	0	0	0	0	0	105
Ridgefield ..G	0	0	0	0	0	95
Sherman ...G	0	0	0	0	0	49
Stamford ...G	0	0	0	0	0	125
Wilton .....G	0	0	0	0	0	75
	1	328	1	1,175	0	832

G, work done by Federal men.

SUMMARY OF STATISTICS

County	No. Towns Covered	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Windham	8	292	21,165	194	5,651	4,913	574
New London	7	* 15	656	7	1,025	1,136	218
Tolland	9	19	1,178	11	573	1,090	132
Hartford	25	84	6,376	42	7,249	2,154	1,530
Middlesex	4	0	0	0	0	0	250
New Haven	14	5	1,030	4	550	0	1,204
Litchfield	25	23	1,454	12	2,525	125	2,257
Fairfield	10	1	328	1	1,175	0	832
	102	439	32,187	271	18,748	9,418	6,997

Parasites

For many years the Federal Bureau of Entomology has had men in various foreign countries where the gipsy moth occurs, and all parasites discovered have been introduced into the United States. Altogether, some three dozen species attacking the gipsy and brown-tail moths have been brought into this country and reared at the Gipsy Moth Parasite Laboratory at Melrose Highlands, Mass. Most of them have been liberated somewhere within the infested area. Some of them have never been recovered, but certain species have withstood our New England winters, and have not only been recovered but have spread some distance from the points where liberated. About a dozen species of parasites of the gipsy and brown-tail moths have apparently become acclimated, and their combined attacks have undoubtedly checked the gipsy moth in many localities. A somewhat detailed account of these parasites was given in the Report of this Station for 1922, pages 314-317, and need not be repeated here. The species and number of individuals of each liberated each year in Connecticut since then have been published in the Reports as follows:

1923, page 265; 1924, page 271; 1925, page 271.

During the period covered by the present Report, only one species (*Anastatus bifasciatus*) was liberated in Connecticut. The number of individuals liberated in each of the towns where placed (a total of 400,000) is given in the following table:

Colebrook	5,000
Plymouth	2,000
Wolcott	9,000
New Britain	10,000
New Hartford	10,000
Burlington	9,000
Harwinton	10,000
Canton	43,000
Barkhamsted	60,000
East Hartford	3,000
West Hartford	5,000

Bloomfield	2,000
Simsbury	14,000
Stafford	9,000
Killingly	21,000
Suffield	6,000
Granby	82,000
Hartland	35,000
Hampton	41,000
Eastford	24,000
	400,000

The Gipsy Moth Quarantine*

(Revision Effective September 20, 1926)

From time to time it is necessary to revise the gipsy moth quarantine to meet changing conditions and to bring it into

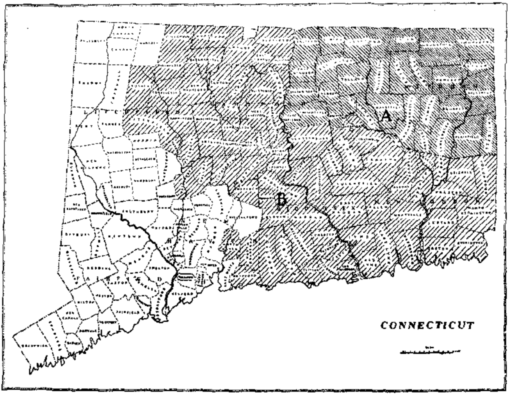

Fig. 1. Map of Connecticut; shaded area quarantined on account of the gipsy moth; (A) Generally infested; (B) Lightly infested.

harmony with the Federal quarantine. The Federal Horticultural Board of the United States Department of Agriculture has recently revised the Federal quarantine relating to the gipsy and brown-tail moths (effective July 1, 1926). The authority for establishing quarantines in Connecticut (Section 2106 of the

* Published as Bulletin of Immediate Information No. 54, October 1, 1926.

General Statutes) was amended by the last General Assembly, Chapter 107, Public Acts of 1925, so that stone, quarry products, and other materials liable to carry dangerous pests may now be included instead of plant products only.

After due notice, a public hearing was held in Hartford on September 9, 1926, and the subject discussed. There was no opposition expressed. The preceding quarantine order relating to the gipsy moth became effective July 20, 1924. Seven towns then placed under quarantine are now released by the present order, namely: Salisbury, Canaan, North Canaan, Norfolk, Cornwall, Cheshire and Wallingford. The two areas (A) and (B) are shown on the accompanying map, and the quarantine order follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

QUARANTINE ORDER NO. 9

CONCERNING GIPSY MOTHS

Inasmuch as it is necessary from time to time to revise the quarantine regulations, to protect the uninfested parts of Connecticut from danger of infestation by the Gipsy Moth, and as the Federal Horticultural Board has made such revision, effective July 1, 1926, and shown on a map published by the United States Department of Agriculture, whereon two areas are designated: (1) a generally infested area, colored red, and (2) a lightly infested area, colored green; by authority given in Chapter 107, Public Acts of 1925, I do hereby proclaim the same areas to be under State quarantine, as follows:

GENERALLY INFESTED AREA (A)

WINDHAM COUNTY:

All of the fifteen towns as follows:

Ashford	Hampton	Scotland
Brooklyn	Killingly	Sterling
Canterbury	Plainfield	Thompson
Chaplin	Pomfret	Windham
Eastford	Putnam	Woodstock

TOLLAND COUNTY:

The ten northernmost towns as follows:

Bolton	Somers	Union
Coventry	Stafford	Vernon
Ellington	Tolland	Willington
Mansfield		

HARTFORD COUNTY:

Five towns east of the Connecticut River as follows:

East Hartford	Enfield	South Windsor
East Windsor	Manchester	

LIGHTLY INFESTED AREA (B)

NEW LONDON COUNTY:

All of the twenty-one towns as follows:

Bozrah	Ledyard	Old Lyme
Colchester	Lisbon	Preston
East Lyme	Lyme	Salem
Franklin	Montville	Sprague
Griswold	New London	Stonington
Groton	North Stonington	Voluntown
Lebanon	Norwich	Waterford

MIDDLESEX COUNTY:

All of the fifteen towns as follows:

Chester	East Hampton	Middletown
Clinton	Essex	Old Saybrook
Cromwell	*Haddam*	Portland
Durham	Killingworth	Saybrook
East Haddam	Middlefield	Westbrook

NEW HAVEN COUNTY:

Seven towns as follows:

Branford	Meriden	Waterbury
Guilford	North Branford	Wolcott
Madison	*North Haven*	

TOLLAND COUNTY:

Three towns as follows:

Andover	Hebron	Columbia

HARTFORD COUNTY:

Twenty-four towns as follows:

Avon	Glastonbury	Rocky Hill
Berlin	Granby	Simsbury
Bloomfield	Hartford	Southington
Bristol	Hartland	Suffield
Burlington	Marlborough	West Hartford
Canton	New Britain	Wethersfield
East Granby	Newington	Windsor
Farmington	Plainville	Windsor Locks

LITCHFIELD COUNTY:

Ten towns as follows:

Barkhamsted	Litchfield	Thomaston
Colebrook	New Hartford	Torrington
Goshen	Plymouth	Winchester
Harwinton		

1. It shall therefore be unlawful to remove any woody nursery stock, trees, shrubs, lumber, cordwood, telegraph or telephone poles, railroad ties, Christmas trees, "Christmas greens," tree branches for decoration, or other forest plant products, or stone or quarry products, or any material likely to carry the gipsy moth, from the generally infested to the lightly infested area, or from either infested area to the non-infested area of the State, except under certificates or permits issued by authorized State or Federal inspectors.

2. In view of possible future changes in the lines between the generally infested, lightly infested, and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the Federal Horticultural Board of the United States Department of Agriculture; furthermore, the Federal regulations covering interstate shipments of materials cited in Section 1 are hereby adopted for the regulation of shipments within the State of Connecticut.

3. This order shall take effect from its date.

Dated September 20, 1926.

W. L. SLATE, JR., *Director,*
Connecticut Agricultural Experiment Station.

Approved:

JOHN H. TRUMBULL,
Governor.

It will be seen that the present quarantine involves fewer towns than the preceding quarantine (Quarantine Order No. 6) and that it follows the Federal quarantine in dividing Connecticut territory into two parts (A), generally infested, and (B), lightly infested, these areas being colored red and green respectively on the Federal map. It also differs from Quarantine Order No. 6 in that it includes stone, quarry products, and any other materials liable to carry the gipsy moth.

MATERIALS AND PRODUCTS REQUIRING INSPECTION

The materials requiring inspection under both Federal and State quarantines may be roughly divided into four classes as follows:

1. **Christmas Greens and Decorations**:—Coniferous trees, such as spruce, hemlock, fir, pine, juniper or red cedar, arbor vitae or white cedar, or foliage thereof, and decorative plants such as holly and laurel or parts thereof known and described as Christmas greens or greenery.

Movement of materials in this class originating in the generally infested area (A) may be moved within the area without inspection, but will not be allowed to points outside of the area. If originating in the lightly infested area (B), they may be moved to other points in the same area or to points in the generally infested area (A) without inspection, but cannot be shipped outside the quarantined area without a Federal certificate or permit.

2. **Nursery Stock**:—Trees, shrubs, vines, cuttings, and florists' stock if woody and field-grown, but not including florists' greenhouse-grown stock or herbaceous plants.

Nursery stock grown within the generally infested area (A) may be moved within the area without inspection, but in order to move it to points within the area lightly infested (B) or to points

outside the quarantine limits it must be accompanied by a certificate of inspection or permit issued by the United States Department of Agriculture. From points in the lightly infested area (B) plants may be moved to other points in the same area or to points in the generally infested area (A) without inspection; to points outside the quarantined area a Federal certificate or permit is necessary. Regular nurseries must hold State inspection certificates or this Federal inspection may be refused.

3. **Forest Products**:—Logs, poles, posts, ties, car stakes, cordwood, lumber, tanbark, etc., but not including square-edged lumber direct from the saw, or lumber direct from the mills and finished on all faces, boxes, shooks, staves, etc., which have not been exposed to infestation by piling or storing out of doors.

Forest products may be moved between points within the generally infested area (A) and from points in the lightly infested area (B) to points within both areas without inspection; but must bear Federal certificates or permits if moved from within the generally infested area (A) into the lightly infested area (B) or from either area to points outside the quarantine limits.

4. **Stone and Quarry Products**:—Field stone, paving, building or monumental stone, etc., brick, tile, drain or sewer pipe.

Such materials may move between points in the same area or from points in the lightly infested area (B) to points in the generally infested area (A) without inspection; but from the generally infested area (A) to points in the lightly infested area (B) or from points in both areas to points outside the quarantine limits, they must be accompanied by Federal certificates or permits.

It is understood that most of these inspections will be made by Federal inspectors, but State inspectors are also qualified to make inspections and issue certificates. Each frequent shipper should procure a Federal map showing these areas in colors, and learn the name, address, and telephone number of the Federal inspector detailed to cover his locality. The Federal inspection service is in charge of

J. N. SUMMERS, 408 Atlantic Avenue, Boston, Mass.

to whom applications for maps and inspections should be made.

The State inspection service is in charge of W. E. BRITTON, Agricultural Experiment Station, New Haven, Conn.

BARRIER ZONE

Some three or four years ago it was suggested that for the protection of New York and other states westward a barrier strip or zone be established, in and beyond which the gipsy moth

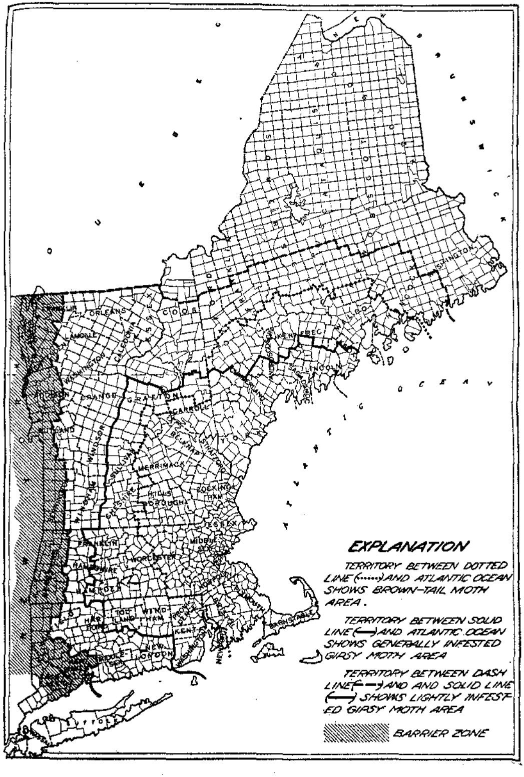

FIG. 2. Map of the New England States showing barrier zone, and generally and lightly infested gipsy moth areas (After Federal Horticultural Board, U. S. Dept. of Agriculture).

should not be allowed to gain a foothold. This idea was subsequently carried out, and extraordinarily thorough scouting has been done in this area each year by Federal and New York State men. Of course some infestations have started in this area, as well as west of it, but if taken in season they can be eradicated. This plan is now being followed and seems to be a sensible one. Had such an area or zone along the Connecticut River been established several years ago, the general infestation of a large area in western New England might possibly have been prevented. The barrier zone extends from the Canadian border southward to Long Island Sound. It includes Lake Champlain, which is a natural barrier, and a strip 25 to 30 miles in width between the Hudson River and the western boundary of New England, but, on reaching the highlands, this zone curves eastward, crossing Connecticut diagonally from the upper portion of Fairfield County to New Haven, as shown in figure 2.

Recommendations

Ever since the extensive wind-spread of 1920-21, funds have not been sufficient to scout the roadsides, orchards, and open fields over the entire area in any one year. The present plan of operation is to cover it in a two-year rotation, a procedure which might be fairly satisfactory if we could be certain of no wind-spread, and that the pest is not increasing. But unless our men go over the entire infested area each season, we cannot learn exactly just what conditions are present. Consequently, on the plan of a two-year rotation, some of the colonies obtain a two-year start before we discover them, and require a proportionately greater amount of work to eradicate them. Even greater is the danger in case a colony starts in a woodland some distance back from a highway or from the margin of the wooded area. Funds have never been sufficient to scout all woodlands in a systematic manner. Occasionally woodland infestations are discovered by accident, but otherwise they may gain considerable headway before their presence is discovered. The longer such colonies exist before being discovered, the more firmly do they become established, and the greater is the difficulty in eradicating them.

Even though seven towns have been released from quarantine, they must still be examined, and probably will be scouted by Federal men. Notwithstanding this, and even with the two-year rotation plan, there is a large area to go over each year, and the appropriation of $100,000 for the biennial period ending June 30, 1927, has not been adequate to do the work necessary to control this pest. We therefore respectfully recommend an appropriation of $120,000 for the biennial period ending June 30, 1929.

THE SPRUCE GALL APHID (*Adelges abietis* L.) AND ITS CONTROL

R. B. Friend

The spruce gall aphid is sometimes a serious pest in nurseries as well as in forest and ornamental plantings, and for this reason experiments were carried on in the spring of 1926 to determine the effectiveness of certain common insecticides in controlling it. In recent years this species has been known as *Chermes abietis* L., but the term *Chermes* is considered to be more properly used in connection with the jumping plant lice, the Chermidae, and the older name for the spruce gall aphid, *Adelges abietis* L., is coming back into favor.

The writer is indebted to Professor R. C. Hawley, consulting forester for the New Haven Water Company, for permission to use a plantation of this Company in these experiments.

Appearance and Life History

This insect causes the formation of galls on the twigs of spruces, and the number of galls found on one tree is sometimes enormous. Miss Patch (1909) reports the occurrence of 990 fresh galls on a white spruce tree three feet tall. The writer made observations in 1926 on an infestation in a plantation of Norway spruce near New Haven. Over a considerable part of the plantation 30 per cent of the trees were badly infested, and some bore several hundred galls, not all of them fresh. When the gall completely encircles the twig, the latter is killed. The twig always grows beyond the gall in the spring, but its growth is retarded, and in the fall it dies. Twig a, on plate IV, shows such a condition. Leaders are often attacked, and the killing of the leader retards the growth of the tree. The killing of both leaders and laterals may develop bushy trees but on account of the dead twigs, a heavily infested tree always looks unhealthy and weak. If the gall does not completely encircle the twig, the latter may live, although distorted in shape and retarded in growth, and finally slough the gall. On plate IV, b, may be seen two galls that did not kill the twig; c plainly shows the typical distortion of the twig and condition of the gall after about four years, and d shows the scar left by a gall which has been sloughed. The healing of the gall injury is similar in appearance to the healing of a wound. Plate V shows a young Norway spruce about seven feet tall with typical gall injury. The leader and most of the tips of the upper laterals have been killed. In the Norway spruce plantation above referred to, a large number of gall-bearing twigs were examined on five trees taken at random and the per cent of dead

twigs calculated. Of 852 gall-bearing twigs examined, 132 were alive and 720 were dead, a mortality of 84.5 per cent of the twigs infested. This represents a serious condition as regards the growth of the tree and its appearance. In this plantation most of the injury was found on trees under ten feet in height. Where the trees were thickly planted, most of the galls were confined to the upper branches, but in more open planting the galls were on all parts of the tree. The number of fresh galls on a tree sometimes increases with the duration of the infestation until practically every twig is infested. Although many of the trees infested were seriously injured and worthless for any future use, in none of the observed cases had death occurred due to galls alone. Herrick and Tanaka (1926) report the death of spruces in hedges as due mainly to the attack of this aphid.

In the United States the principal hosts are Norway spruce (*Picea excelsa*), and white spruce (*P. canadensis*). Britton (1924) reports the presence of galls on red spruce, black spruce, and occasionally hemlock. The galls found on the Colorado blue spruce are caused by a different species, *Gillettea cooleyi* Gill. This latter species makes a large gall on the tip of the twig, whereas the gall of *Adelges abietis* is smaller and is always at the base of the twig. The habits of the two species also differ in that *Gillettea cooleyi* spends part of its life cycle on the leaves of the Douglas fir but does not form galls on this tree. On plate VI, is shown the form on Douglas fir and that on Colorado blue spruce. On the Sitka spruce this is also a serious pest. Although it is a generation in the life cycle of *Gillettea cooleyi*, the form on Douglas fir is known as *Gillettea cooleyi* var. *coweni* Gill. Control measures are the same as for *Adelges abietis*.

The life history has been worked out by Fernald and Cooley (1898) and by Herrick and Tanaka (1926), and these authors may be consulted for a detailed study. Only those facts bearing on control will be mentioned here. The young wingless females hibernate on the under side of the spruce twigs close to the buds. They are at this time about 0.4 mm. in length and a dark slaty gray in color. The presence of a few white waxy threads secreted by the insect gives it a slightly woolly appearance. The last of April the young females molt and become sexually mature. The woolly appearance becomes accentuated by an increased secretion of white waxy threads which cover the insect and eggs completely. On plate III, a, center, part of the waxy covering has been removed to show the eggs; right view is uormal. The period of oviposition seems to coincide with the breaking open of the spruce buds and occurs during the first and second weeks of May. Each female lays about 100-200 eggs, and these hatch in about one week. By this time the young needles have appeared on the twigs, and the newly hatched young crawl to the bases of the new needles

and attach themselves permanently. Although it has been claimed that the gall is started by the feeding of the hibernating female, certainly no gall develops unless the young feed on the needles. The irritation brought about by the feeding of the young causes the bases of the needles to swell until they touch each other. The final result is one continuous gall with the young aphids enclosed in pockets inside. These galls break open in August, and the fully grown nymphs come out and crawl to the needles. They molt once and transform to sexually mature winged females which lay eggs on the needles, about 40-50 eggs per female, and from these in about two weeks the overwintering forms hatch. After wandering about a short time, these hibernating females settle on the twigs for the winter. Plate III, a, at left, shows the young on the twigs, but the photograph does not represent the typical location, for the insects tend to cluster about the bases of the buds. There is a very heavy winter mortality, comparatively a small per cent of the overwintering nymphs surviving. However, the survival of one young female at the base of a bud is sufficient to cause the formation of a gall in the spring. To the best of our knowledge there are no males of this species, all reproduction being parthenogenetic.

Control

Laboratory tests with various insecticides were made by dipping Norway spruce twigs bearing hibernating nymphs in the insecticide for an instant. The twigs were examined 24 hours later. These tests were carried on the last week in March, 1926, and the results are indicated in the following table:

Laboratory Tests

Insecticide	Dilution	Per cent dead
Carbolic acid emulsion	1-15	96
	1-20	100
	1-25	100
Kerosene emulsion	1-25	100
	1-30	100
	1-35	100
Nicotine sulphate (40%)	1-800 (+ soap)	100
Scalecide	1-30	100
Sunoco	1-25	100
	1-30	100
	1-35	100
Volck (80% oil)	1-25	100
Whale oil soap	1 lb. in 10 gals.	96
	1 " " 7.5 "	100
	1 " " 5 "	100
Check—water		none
Check—no treatment		none

The nicotine sulphate contained enough whale oil soap to make 0.5% of the weight of the diluted material. Three to five twigs were used in each trial, each bearing 10-25 live aphids.

On the basis of these tests, field spraying experiments were made on Norway spruce trees during the first part of April, 1926. The trees were from three to eight feet high and were all heavily infested with galls. Three trees were sprayed with each insecticide. Six days after the first application the trees were examined, and some of the treatments were apparently not as effective as was desired. Stronger sprays of the same material were then applied to one or two of the three trees previously treated and to one additional tree not previously treated. The sprayed trees thus fall into three groups: (1) receiving one application of the weaker spray; (2) receiving two applications, one of the weaker, and one of the stronger spray; (3) receiving one application of the stronger spray. Six trees were kept untreated as controls. The trees were all examined at intervals for nine months after spraying, and no injury to foliage was detected that could be attributed to the insecticide. Not all the materials tested in the laboratory were applied in the field. The following table gives those that were used.

FIELD APPLICATIONS

Insecticide	Dilution	Applied	Trees	Galls developed
Carbolic acid emulsion..	1-20	April 3	2	22
	{ 1-20 1-20	" 3 " 16 }	1	none
	1-20	" 16	1	12
Nicotine sulphate (Black Leaf 40)	1-800 + 0.5% soap	" 3	2	75
	{ 1-800 + 0.5% " 1-500 + 0.7% "	" 3 " 16 }	1	3
	1-500 + 0.7% "	" 16	1	none
Scalecide	1-30	" 3	1	none
	{ 1-30 1-30	" 3 " 16 }	2	none
	1-30	" 16	1	none
Sunoco oil	1-35	" 3	1	30
	{ 1-35 1-25	" 3 " 16 }	2	none
	1-25	" 16	1	none
Whale oil soap	1 lb. in 8 gals.	" 3	1	none
	{ 1 lb. " 8 " 1 lb. " 5 "	" 3 " 16 }	2	1
	1 lb. " 5 "	" 16	1	none
Control trees	No treatment			100-200 per tree

The number of infested twigs per tree was not determined before the sprays were applied, so no percentages are given as regards control. The carbolic acid emulsion gave indefinite

results. The three galls found on the tree receiving two applications of nicotine sulphate, and the one gall found on the tree receiving two applications of whale oil soap were probably due to missing the twigs in the spraying operation. The soap was added to the nicotine sulphate to act as a spreader, and the amount given is per cent of the diluted spray as applied. Nicotine sulphate diluted 1 to 500, Scalecide diluted 1 to 30, and Sunoco oil diluted 1 to 25 gave excellent results with one application. Other miscible oils and oil emulsions would probably give just as good control if diluted to the same relative strength. If spruce mites are present on the trees, the miscible oils are preferable, as they control mites as well as aphids.

Dr. Garman of this Station sprayed some spruce trees in the same block with lime-sulphur (commercial, testing 32 degrees Baumé) diluted 1 to 16 and 1 to 40. No galls developed on the trees and the foliage was not injured. This insecticide adheres to the foliage for weeks and may be objectionable under some conditions for this reason. The trees were sprayed April 3. The 1 to 40 strength was just as effective as the 1 to 16.

The trees must be sprayed while dormant in order to obtain good results. If the trees are sprayed after the buds open, not only is there danger of foliage injury, but at this time the aphids are covered by a very thick coat of waxy threads which protects them from the insecticide. It is useless to spray after the galls are formed. The spray should be applied between the first of November and the middle of April, and the twigs must be thoroughly covered, especially on the under side. One good application of the insecticide will keep the trees free of galls for the season.

Experiments of Other Workers

For the detailed results of other workers in spraying for this aphid, the bibliography may be consulted. Fernald and Cooley (1898) recommend whale oil soap at the rate of 1 pound in 2 gallons of water. Herrick (1925) recommends miscible oils diluted 1 to 20, or powdered lime-sulphur at the rate of 16.5 pounds in 50 gallons of water, and Herrick and Tanaka (1926) obtained good results with lime-sulphur (32° Baumé) diluted 1 to 8. Britton (1924) states that spring or fall applications of miscible oils diluted 1 to 20 are effective and have caused no foliage injury when used several successive seasons. Bourne (1926) obtained excellent control with an oil emulsion (Volck) diluted 1 to 25, and with miscible oils diluted 1 to 25. These insecticides were used at slightly greater strengths than those used by the writer, and no injury to the trees resulted. However, for several reasons, the weakest *effective* spray is the best and should be used.

Recommendations

For the control of this insect it is recommended that the trees be sprayed *while dormant*, preferably during the first two weeks of April, with any one of the following materials:

Miscible oils diluted 1-25.
Whale-oil soap 1 pound in 8 gallons of water.
Nicotine sulphate, containing 40 per cent nicotine, diluted 1-500 plus soap (enough to make 0.5 per cent, by weight of the diluted spray).
Commercial lime-sulphur, testing 32 degrees Baumé, diluted 1-40.

The tips of the twigs must be thoroughly covered, particular attention being given to the under side.

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FURTHER REPORTS ON SPRAYING AND DUSTING OF APPLES

E. M. Stoddard and M. P. Zappe

This is the seventh report we have made on spraying and dusting experiments in Connecticut, and six of these have data on the orchard on which we are reporting this year. Besides the comparison of a complete spraying schedule with a complete dusting schedule, we have continued trials on the most promising combination treatments. These combination treatments have proven quite successful, and are being used in a number of commercial orchards.

The results of previous experiments made by this Station have been reported in the following Station publications: Entomologist's Report 1920, page 168; Bulletin 235; Bulletin 245; Entomologist's Reports for 1923, 1924, and 1925.

Orchard Under Experiment

The orchard of Mr. Frank N. Platt, in Milford on which experiments were started in 1921, was used in 1926. The trees in this orchard are 22 years old, growing in sod, and with nitrate of soda as a fertilizer, and are in good growing condition. The varieties used were Baldwin, Greening, Gravenstein and McIntosh.

Materials and Apparatus Used

The following materials were used in this experiment:

SPRAY

Dry Lime-sulphur	6 pounds
Lead Arsenate	3 pounds
Water	100 gallons

No nicotine was used in any of the treatments.

POMODUST

Sulphur	90 parts by weight
Lead Arsenate	10 " " "

KOLOTEX DUST

Sulphur	85 parts by weight
Lead Arsenate	15 " " "

This is a new dust manufactured by the Niagara Sprayer Co., after a new process which produces a very fine dust, which is more economical to use than coarser dust and is said to have excellent sticking qualities.

We have no data on the sticking qualities, but per unit of weight it seemed to cover more area than Pomodust with which it was compared.

A new Sulphur-Lead Arsenate Dust known as Naco Dust, put out by the Nitrate Agencies Co., was tried in a limited way, but not sufficiently to warrant making any comment on its physical properties, or its insecticidal or fungicidal value.

Arrangement of Plots

The orchard was divided into seven plots of two rows each running across all the varieties. One of these plots was a spray barrier to prevent dust blowing onto the check plot, and the data were not used in making comparisons.

The arrangement of plots and schedule of treatment are shown in the following table:

	No. 1 Pink May 11	No. 2 Calyx May 27	No. 3 1st after calyx June 9	No. 4 2d after calyx July 1
Plot 1	Spray	Spray	Spray	Spray
Plot 2	Pomodust	Pomodust	Pomodust	Pomodust
Plot 3	Kolotex Dust	Kolotex Dust	Kolotex Dust	Kolotex Dust
Plot 4	Spray	Spray	Pomodust	Pomodust
Plot 5	Spray	Pomodust	Pomodust	Spray
Plot 6	Check	Check	Check	Check
	No treatment	No treatment	No treatment	No treatment

All varieties received the four applications.

Method of Recording Data

The data on the results of treatment were taken as in previous years, which in brief consisted of examining all the apples from selected trees in each plot, and recording the several injuries and perfect fruit on a series of tally registers arranged on a board so placed on the sorting table that each person scoring fruit could record his own data. This scoring device is described in detail on page 273 of the Entomologist's Report for 1925. A total of 275,968 apples were scored on the four varieties for all the treatments.

Results of Treatment on McIntosh

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
	Spray	Pomodust 90-10	Kolotex Dust 85-15	Spray 1, 2 Dust 3, 4	Spray 1, 4 Dust 2, 3	Check
Good	82.0	81.96	81.96	81.20	78.55	42.15
Aphis	5.44	8.13	11.06	10.62	12.72	12.38
Red bug	1.84	1.82	1.70	1.41	2.18	13.21
Codling moth	1.50	.32	.07	.04	.01	2.5
Curculio	3.68	1.78	1.59	1.38	1.74	23.06
Eulia	.5	.85	.79	.68	.58	1.67
Other chewing insects	5.91	4.71	3.06	3.81	3.57	6.22
Scab	.08	1.04	.35	1.51	1.35	23.99
Sooty blotch / Fruit speck	0	0	0	0	0	0

Discussion of Results

It will be noted that all the treatments gave approximately the same percentage of good fruit. Scab infection on the treated plots was a negligible quantity and even on the check the per cent of infection was remarkably low. This was due to the lack of rain in May and a later development of the foliage than usual so that the young leaves matured during a period of scant rainfall and low humidity. Judging from a series of experiments designed to show when infection occurred there was only one period of two days, May 14 and 15, when there was any appreciable amount of infection.

Results of Treatment on Greening

	Plot 1 Spray	Plot 2 Pomodust 90-10	Plot 3 Kolotex Dust 85-15	Plot 4 Spray 1, 2 Dust 3, 4	Plot 5 Spray 1, 4 Dust 2, 3	Plot 6 Check
Good	83.56	82.1	79.68	87.86	78.58	5.99
Aphis	10.73	9.67	12.96	4.2	10.57	12.94
Red bug	.38	.47	.15	.19	.21	11.3
Codling moth	.26	.1	.12	.12	.21	4.49
Curculio	2.47	2.06	2.22	2.12	3.3	60.68
Eulia	1.85	2.72	2.00	2.45	3.17	11.5
Other chewing insects	1.37	2.3	1.41	2.16	3.07	5.99
Scab	.08	.07	0	.09	.09	2.8
Sooty blotch	.20	.58	1.11	.23	.38	22.65
Fruit speck	.05	.28	.84	.4	.42	20.29

Discussion of Results

With this variety we note a difference in the value of the treatments judging by the per cent of good fruit. In Plot 4 the higher per cent of perfect fruit is explained by the marked decrease in aphis infection which is unaccounted for, as there were no control treatments for aphis used. In Plot 5 the decrease of good fruit is due to a slight increase in curculio, Eulia and other chewing insects. All treatments showed good control of red bug, which must have been due to repellent action of the materials, as no nicotine was used. This variety showed more Eulia damage than did the other varieties; also sooty blotch, fruit speck and curculio showed higher percentages of injury on the check plot, but were well controlled on all the treated plots.

Results of Treatment on Gravenstein

	Plot 1 Spray	Plot 2 Pomodust 90-10	Plot 3 Kolotex Dust 85-15	Plot 4 Spray 1, 2 Dust 3, 4	Plot 5 Spray 1, 4 Dust 2, 3	Plot 6 Check
Good	80.1	79.4	70.84	86.42	77.3	17.67
Aphis	15.96	15.07	21.78	10.06	18.31	35.55
Red bug	1.22	.96	.78	1.0	.99	13.85
Codling moth	.12	.12	.07	.14	.04	1.97
Curculio	1.32	2.03	4.49	.74	1.61	48.58
Eulia	.49	.96	.71	.46	.75	1.61
Other chewing insects	1.26	1.74	1.72	.10	1.47	8.87
Scab	.08	.31	.27	.15	.24	2.41
Sooty blotch	.04	.37	.09	.52	.16	.4
Fruit speck	0	0	0	0	0	0

Discussion of Results

Plot 4 showed an appreciably higher per cent of good fruit which can be accounted for by reduction of the damage by curculio and other chewing insects and a decrease in aphis injury. This variety had the heaviest infestation of aphis of any of the varieties on both treated and untreated plots, a usual and expected condition.

Result of Treatment on Baldwin

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
	Spray	Pomodust 90-10	Kolotex Dust 85-15	Spray 1, 2 Dust 3, 4	Spray 1, 4 Dust 2, 3	Check
Good	87.38	88.43	95.89	90.94	87.3	14.12
Aphis	9.98	3.87	4.2	4.38	5.99	4.66
Red bug	.74	.16	.09	.08	.16	2.66
Codling moth	.26	.27	.23	.14	.09	4.3
Curculio	.88	2.63	1.49	1.15	1.57	48.84
Eulia	.42	1.5	1.05	.9	1.84	4.06
Other chewing insects	.94	3.44	2.28	2.58	3.39	41.15
Scab	0	0	0	0	0	0
Sooty blotch / Fruit speck	0	0	0	0	0	8.66

On this variety the treatments on Plots 3 and 4 gave the highest per cent of good fruit which was mostly due to the lesser amount of aphis infestation. It will be noted that spraying controlled codling moth, Eulia and other chewing insects better than any other treatment. Scab was not present on this variety at all, and fruit speck and sooty blotch occurred only on the check plot. We do not account for the very high percentage of injury by other chewing insects on the check plot, and the insect causing this injury was not determined. It evidently occurred early in the season and may have been caused by canker worms.

Summary and Comment

As a method of comparison of the relative value of the different treatments we present the following table. In this table the varieties are arranged opposite the several injuries under the treatment which gave the best control, and in the case of good fruit under the treatment giving the highest percentage, e. g., our data show that curculio was best controlled on Baldwin by spraying, this being indicated in the table by the letter B under "Spray" and opposite "Curculio." If several treatments gave the same control the variety is listed under each one.

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Good	M		B	G Gr	
Aphis	M	B		G Gr	
Red bug			G Gr	B M	
Codling moth		Gr			B G M
Curculio	B	Gr		G M	
Eulia	B M Gr			G	
Other chewing insects	B Gr		M	G	
Scab	B G M	B	B Gr	B	B
Sooty blotch	B G M Gr	B M	B M	B M	B M
Fruit speck	B G M Gr	B G M	B G M	B G M	B G M
Total score	19	9	11	16	9

B—Baldwin. M—McIntosh. G—Gravenstein. Gr—Greening.

From this comparison we find spraying to have three points more to its credit than its nearest competitor, which was the combination treatment on Plot 4. This result tallies with the results obtained in 1925 and further confirms our belief that spraying is necessary, in the early treatments at least, to ensure a high per cent of perfect fruit. The failure of the combination on Plot 4 was due to lack of control of sooty blotch and fruit speck on Greening and Gravenstein, and this we believe is its weak point and would necessitate the substitution of spraying for the last dust treatment in a year of abundant rainfall in the latter part of the summer. Dusting did not give as good results compared with spraying as it did in 1925, which seems to be accounted for by lack of control of curculio, Eulia and other chewing insects.

It will be noted that only four treatments were given this year, the pre-pink and last summer treatment being omitted on all varieties. The pre-pink was deemed unnecessary on the McIntosh because of the dry weather prevailing at the time it would have ordinarily been applied. There did not seem to be any real need of the last summer treatment as weather conditions did not presage a serious infection of sooty blotch and fruit speck. A scarcity of insects made treatment for their control unnecessary. This forecast proved correct except in the case of Greenings, where a light infection of sooty blotch and fruit speck developed following eight days of rain in August, which infection might have been controlled by an extra treatment in the early part of August. Other than this our data do not show that there was lack of control of any pest more than is normally expected.

Among the insect pests curculios and aphis caused the largest amount of damage, but the curculios were well controlled by all treatments, and the aphis did no real damage except on Gravenstein, and perhaps here they were a blessing in disguise, as the trees were so heavily set with fruit that the 15-20 per cent of aphis apples took the place of thinning which the trees did not have.

ACKNOWLEDGMENTS

The writers are indebted to Mr. Frank N. Platt for the use of the orchard, power sprayer and assistance in conducting the experiments, also to Messrs. B. H. Walden, J. L. Rogers, and A. D. McDonnell who assisted in scoring the fruit at harvest time. We also wish to acknowledge the assistance rendered by Dr. Florence A. McCormick in examining scab material.

WORK WITH THE ORIENTAL PEACH MOTH IN 1926

PHILIP GARMAN

1. **Distribution.** The present distribution of the Oriental peach moth in Connecticut remains much the same as reported two years ago except for the fact that the population seems to be increasing in density in Fairfield and New Haven Counties. An infestation of considerable severity was observed on the Massachusetts line, and it has been reported from nurseries in the vicinity of Storrs. Outside the State the pest has now been reported from New York, New Jersey, Delaware, Maryland, Virginia, Pennsylvania, North and South Carolina, Florida, Alabama, Texas, Arkansas, Missouri, Georgia, Tennessee, Ohio, Indiana, and perhaps others. It has also been found in Ontario, Canada. So far it seems to be most destructive in New Jersey and Pennsylvania, although word has been received that the Canadian infestation is very severe. It seems probable, therefore, that the insect may extend its range northward in the eastern United States as far as peaches are grown.

2. **Life History Studies.** Three broods were evident this year, and there was no sign of a fourth as in 1925. Bait-pan records indicate three distinct periods of maximum abundance corresponding in general with life history studies made in the insectary. Four field cages placed over individual trees were maintained, and these also indicated a three-brooded condition for 1926. An interesting point in connection with field cage records is the increased length of time occupied by the later generations even if started from a few individuals placed in a cage on a given date early in the summer. Thus, in our cages where adults were liberated early in June or July, adults were continually present from the first week in August until the tenth of September. Records from bait pans indicate that moths are present in the orchard until the latter part of September, which means an even longer period of activity than occurred in field cages. For the last brood it appears that their flight extends from about the fifth of August until about September 25, and reaches its maximum abundance near the first of September.

3. **Control Studies.** Through the courtesy of the Barnes Nursery & Orchard Company of Wallingford, Conn., several plots of Elberta were made available for control studies. Bait pans were used as a means of control, the material employed as bait being diluted molasses (1 part in 20 parts water). The pans were refilled once a month and fresh molasses added about once a week. Pails of the sort used (two-quart tin pails) require almost constant attention to be kept in working order, since they dry out rapidly in dry weather, fill up and run over in wet weather, become choked with other species of moths during certain periods of fermentation, and if not fastened to a rigid part of the tree, will spill over with a slight wind. In addition to actual work in the orchard, a three-gallon enameled pail was provided with bait and hung in the center of one of our field cages. Eleven moths were then liberated in this cage. None were caught in the pail and the twigs and fruit became generally infested with larvae. Later two smaller pails were hung in the same tree, but placed higher than the large enameled pail just described. These pails caught a number of moths, but by no means all of them, and many eggs were laid within a few feet of the pails.

It seems difficult to reconcile these facts with field experience where large numbers of moths are caught daily, but the only choice we have is to reason that the total Oriental peach moth population in an orchard is very great, and that relatively few are caught by the pail method. However, should any degree of control be obtained in orchard practice, it would certainly be encouraging. Our results are shown in Table I and indicate no advantage from the use of pails over plots without pails. A decided change in our present methods of bait-pan control, therefore, seems to be desirable. It also appears that workers in Pennsylvania and New Jersey have not obtained satisfactory control, so we are still much at sea regarding control of the Oriental peach moth by this means.

In addition to bait-pan work, two plots were sprayed with special preparations consisting of (1) lime-fluoride-sulphur-casein, and (2) lime-lead-arsenate-sulphur-casein mixture followed by a thorough spray of nicotine sulphate in August. A continuous coating was maintained on the fruit from June until late in August, but in spite of this coat no substantial increase in sound fruit was obtained. The main part of the infestation seems to have come after August 25, or after much of the spray had disappeared from the fruit and foliage. Herein, it seems to me, lies one of the greatest difficulties in controlling the Oriental peach moth, at least by means of any known sprays.

It was noticed this year that there was much less of an infestation on the same trees than last year. What caused this reduction can only be surmised, but there are several things which undoubt-

edly helped bring it about. Cultivation and parasitism were important factors. A third, perhaps much less important, may be found in the cool, rainy period during the time when the third brood was at its height. Our score indicated 10% to 20% less wormy fruit than was encountered last year, which shows that certain agencies were at work reducing the number of insects in the orchard.

Parasites

The parasite *Trichogramma minuta* Riley was obtained from eggs of the Oriental peach moth at New Haven. A considerable number of eggs laid on quinces near the laboratory were found with parasites, but only one adult specimen was obtained. They were seen in August and September.

Table I. Record of Field Treatments for Control of the Oriental Peach Moth

PICKED FRUIT

Plot	Treatment	Cut Fruit % Injured	Uncut Fruit % Injured	Total No. Cut Open	No. Examined without Cutting
A	Pail in every tree......	12.7	7.2	1,024	3,345
B	Pail in every other tree	9.7	5.8	1,370	5,791
C	Check—No pails	10.5	5.4	928	4,366
D	Fluoride, Lime, Sulphur, Casein-lime — 4 treatments	16.5	7.0	1,586	7,639
E	Lead Arsenate, Lime, Casein-lime—2 sprays; Lime, Casein-lime — 1 spray; Nicotine sulphate—1 spray	22.7	10.4	1,304	6,326
F	Check — Fungicide only	18.6	12.7	1,331	6,295

Notes.—Eight to ten count trees were selected in each plot and representative samples were examined from each. The variation in percentages of infested cut fruit from different trees is as follows:—(A) 4.9-20.2%, (B) 1.8-14.0%, (C) 3.2-19.6%, (D) 5.9-20.7%, (E) 5.6-34.2%, and (F) 8.2-33.3%. If thinnings are included in the count D and F average nearly the same, while E averages nearly four per cent higher than D and F. No thinnings were made on plots A, B, and C and the number of peaches per tree at picking time was greater than was found on D, E, and F. The plots were laid out so that the prevailing winds blew across them and not from one to another. In the sprayed plot the check (F) formed a figure H, the count trees being located in both uprights and crossbar while the sprayed plots D and E were located between the uprights and on either side of the crossbar. About 50 trees were used in each plot including those with bait pans, the trees being approximately the same size as those used in 1925 and shown in Bull. 275, Pl. VI, a. The spray materials used on D and E con-

sisted of a very large percentage of hydrated lime, 30 pounds per 100 gallons and the trees were fairly whitewashed with it. The original mixture also contained 20 per cent calcium fluoride. No injury could be seen except a slight burn from the early applications on E. D remained throughout the season without any sign of injury either in the form of dropped foliage or bark cankers. Dates of spray applications June 8, July 10, August 2, August 19.

Notes on the Feeding Habits of the Oriental Peach Moth with Special Reference to Artificial Foods

Since the Oriental peach moth larva has not been successfully poisoned by any insecticide in common use to-day, it was thought advisable to study artificial foods upon which the larva might be induced to feed and develop, with a view of incorporating some poison with whatever food might prove acceptable. With this in view, agar was first tried alone and as a medium for various sugars and acids but proved too soft. No combination stiff enough for the purpose could be made. Flour dough was next tried and it was observed immediately that the larvae would feed on this material. Consequently feeding tests were begun, mixing with the dough certain sugars, acids, and other compounds, and the following notes relate to this work. Pure flour dough was found to ferment too rapidly to be of much use, but mixtures containing citric and malic acid were more permanent, although even here the material became moldy, and it is probable that some of the difficulty encountered in carrying the larvae through a number of instars was due to this factor. It was noted in the course of the work that larvae would not feed much until they had dug into the food and had spun a thin web over the point of entrance. There was some difficulty at first in determining whether the larvae actually fed upon the materials offered, but it was soon found that the color of the excretory pellets is quite different when the insect is fed artificial food than when fed upon natural foods. It is also fairly easy to distinguish excrement from pellets taken in the mouth and then laid aside before beginning to feed. Plate XVI, b, shows a larval tunnel in one of the artificial mixtures described.

It will be seen from the following notes that while the insects did not develop naturally on any of the foods, in several cases they passed through complete instars and survived for as much as three weeks on the artificial media. Probably the most successful mixture used was No. 10, containing two acids and two sugars, but it may be possible to simplify and improve this so that still greater development will be apparent. Some success will be noted with several other combinations, but none of them is completely satisfactory in promoting growth in the Oriental peach moth larva.

(1) July 27. A mixture of flour, water, casein and malic acid (5%); four larvae used; all entered in 24 hours.

(2) July 28.

Flour	50 gm.
Casein	5 gm.
Water	35 cc.

Two larvae used; both entered and fed; a mixture of 50 gm. flour and 35 cc. water was also fed to three larvae.

(3) July 29.

Flour	50 gm.
Malic acid	5 gm.
Amygdalin	1 gm.
Water	35 cc.

The material was divided and larvae placed as follows: (1) two nearly full grown and one half grown, one larva spun July 30; (2) one two-thirds grown, three recently hatched; (3) one nearly full grown; (4) one about two-thirds grown and one very young—all larvae entered and fed inside of five hours.

(4) August 7.

Flour	50 gm.
Malic acid	2 gm.
Cane sugar	5 gm.
Peach leaf juice[1]	35 cc.

The material was divided as follows: (1) two half grown larvae were used but both were lost August 13; (2) two larvae, one of which was nearly mature; one of these spun August 16.

(5) August 17.

Flour	50 gm.
Dextrose	10 gm.
Malic acid	1 gm.
Peach leaf juice[1]	35 cc.

Three larvae were used. On August 18 two were found feeding and continued alive until August 23, when two larvae spun; one became sick on August 27 and was removed. One adult emerged September 9 and one September 12.

(6) August 24.

Flour	50 gm.
Dextrose	10 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Water	38 cc.

One larva about two-thirds grown was introduced and fed readily on the material; continued alive until September 1 and spun on this date.

(7) August 24.

Flour	50 gm.
Dextrose	10 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Dried peach leaf extract	38 cc.

Two larvae 5 to 7 mm. long were used; still alive August 30 and apparently nearly ready to spin September 2; lost after this day but a cast head capsule was found August 30 among the frass of the mixture.

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[1] Peach leaves macerated in water.

(8) September 1.

Flour	50 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Cane sugar	10 gm.
Water	38 cc.

One larva used—width of head September 1, .33 mm.; molted September 3, width of head as near as could be determined .44 mm.; still alive September 9 but sick and stopped feeding.

(9) September 3.

Flour	50 gm.
Cane sugar	10 gm.
(Certo) pectin	40 cc.

Two larvae used in separate containers but neither of them fed.

(10) September 9.

Flour	50 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Dextrose	5 gm.
Amygdalin	5 gm.
Water	38 cc.

One larva used; width of head capsule .66 mm.; O. K. September 18; molted September 23; size of head capsule .77-.8 mm.; still O. K. September 29; molted October 4, head .99 mm. wide—observed shortly after molt on October 4; died about a week later.

(11) September 9.

Flour	50 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Dextrose	10 gm.
Benzaldehyde (1 drop in 100 cc.)	38 cc.

One larva, head .66 mm. wide, was used; still alive on September 14 but not seen after that day.

(12) September 28.

Flour	50 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Water	38 cc.

One larva with head .5 mm. wide, length 5-6 mm.; molted September 30; still alive October 22 when head capsule measured .88 mm. in width; this was evidently the last instar, was considerably undersize, but pink in color.

EUROPEAN CORN BORER CLEAN-UP WORK IN 1926

W. E. Britton and M. P. Zappe

The fall work in cleaning up the 1925 European corn borer infestations was suspended late in December on account of inclement weather, and was described in the Report of this Station for 1925, page 303. The remaining clean-up work was done in the spring of 1926 and was all in the towns of Stonington and Groton, where 5,091 gallons of furnace oil were used in burning, and 97 man days of labor expended.

Corn stalks and weeds lose much of their moisture during the

winter months and consequently burn more readily in spring, and require much less oil per acre. Where there is considerable work to be done, however, it is hardly safe to leave it all until spring, because the season then comes on with a rush, labor is in greater demand, and the work may not be finished. It seems best, therefore, to do some of the burning in the fall, even if more difficult, and it precludes the possibility of infested material being scattered during the winter.

Infestations Discovered in 1926

During the summer of 1926, Federal men scouted all of the shore towns of Connecticut, and also the towns of North Stonington, Ledyard, Montville, Essex, North Branford, North Haven, Hamden, Orange, Woodbridge, and New Canaan. As a result of this scouting, one infestation was found near Woodmont in the town of Milford, and several others in the towns of East Lyme, Waterford. New London, Groton, and Stonington. A second scouting was given around all infestations, but no borers could be found in Old Saybrook or Bridgeport, which were infested in 1925, though both places were scouted twice. Certain portions of Groton and Stonington infested in 1925 were not found infested in 1926.

MILFORD

The infestation in Milford was discovered in a five-acre field of sweet corn near the house of the owner, Mr. J. R. Quirk, in the eastern or Woodmont section of the town. In all, only four borers were found. Three were found at the time of the first examination, August 27, and another was found on September 7, when the field was rescouted. Altogether 257 fields, or about 472 acres of corn were scouted in the town of Milford.

Late in November, all corn stalks, weeds and trash in the infested field, and also in a two-acre field close by, and all weeds and trash around both fields were burned by State and Federal men working together. About 1,800 gallons of furnace oil were used, and the labor amounted to 45 man days.

EAST LYME

Corn borer infestations were found in East Lyme in 1923 and 1924, but none in 1925. Those of 1923 and 1924 were perhaps two miles apart. In 1926, six separate infestations were found, having a total of 28 borers. Four of these infestations were in small adjoining gardens, one on the Morton farm only a stone's throw away, and the sixth was in a two-acre field of corn about two miles to the eastward beside the State road and with no other

corn fields or weed areas near it. All these infestations are in or near the village of Niantic.

Clean-up burning work was started at the Morton farm, December 1, by State and Federal men. The small back-yard gardens were also completed on December 3, and the sixth or last infestation in the town was burned on December 4, but on account of a snowfall followed by more snow, it was necessary to postpone all further clean-up efforts until the spring of 1927. The work already accomplished in East Lyme required 49 man days, 2,373 gallons of oil were used, and about 12 acres of corn fields and weed areas were burned over. Only a small amount of work will be necessary to finish cleaning up the infestations in this town.

WATERFORD

For the first time the town of Waterford was found infested by the European corn borer in 1926. Four separate infestations occur in the southwestern or Millstone section of the town. Three of them are on one farm, and the fourth is in a small garden about a quarter of a mile away. Altogether 37 borers were found. Clean-up operations will involve burning some fairly large fields of corn and adjacent weed areas.

NEW LONDON

In 1925, a corn field of about one-half acre on Park Street, owned by Mr. J. J. Higgins, was found infested, and all corn, weeds and trash on it were burned, and similar treatment was given six other small gardens in the neighborhood. In 1926, eleven borers were found in corn on the same field at Mr. Higgins'. A second infestation was discovered in the rear of the Pequot Colony Dairy Farm, on Montauk Avenue, where a bottling plant is maintained in a residential section. Three borers were found here, and it will be necessary to burn over a large field of weeds in the spring clean-up.

GROTON

The European corn borer has been found in Groton each year since 1923. Though burning has been the clean-up method practiced each year, 50 borers were found in 1926, one in the borough of Groton, and the others in the village of Noank, where the infestation was rather general last year. In fact, all infested yards in Noank may be considered as belonging to one rather large infestation. Considerable clean-up work will be necessary here in the spring. Last year three infestations were found in Groton in the village of Mystic, but this year no borers could be found there.

STONINGTON

In 1926, a total of 36 European corn borers was found in eight separate infestations in Stonington. With one exception, all were in small back yard gardens in the eastern portion of the village of Mystic, where infestations were found in 1925. The other infestation is situated on the farm of James E. Lord, on Lord's Hill at Quiambog, where two borers were found, and where a small infestation occurred in 1925. Control measures will begin in the spring as soon as weather conditions permit. In 1925, infestations occurred near Old Mystic and Lower Pawcatuck, but no borers could be found at these places in 1926.

It is interesting to note that in certain cases isolated infestations in several towns have apparently been completely eradicated, as no borers could be found in the vicinity the following year. In certain other cases similar infestations have not been eradicated, and this is particularly true where borers occurred in several adjoining yards in Mystic and Noank. Here the householders often clean up their back yards by dumping corn stalks, weeds and rubbish into the water. This is a poor practice, as it leaves the material on the shore or it may be washed away by the tides and other infestations started. In one case in Noank, the clean-up men had to fish the wet material out of the water and place it upon the shore above high-water mark to let it dry for a few days before it could be burned.

The following table shows the results of scouting by the Federal men, to whom we are greatly indebted for their help and co-operation:

SUMMARY OF SCOUTING FOR EUROPEAN CORN BORER, 1926

County	No. Acres *Corn Scouted*	No. Fields *Scouted*	No. Man *Days*	No. Borers *Found*
New London	1,335	1,815	287	165
Middlesex	517	1,168	62.5	0
New Haven	1,687	1,324	166.5	4
Fairfield	866	1,208	104	0
Total	4,405	5,515	620	169

Federal Corn Borer Quarantine

Since preparing this Report for publication, a Federal quarantine has been placed upon the towns of East Lyme, Waterford, New London, Groton, and Stonington, on account of the European corn borer. This quarantine became effective March 1, 1927, and the quarantined area is shown in figure 3. Evidently this area is connected through Rhode Island with the large infestation in eastern New England, but we expect that clean-up measures will

be taken wherever infestations are found, in the hope that the spread of the pest may be materially retarded by such means.

The quarantine restrictions provide that corn on the ear and broom corn (including all parts of the stalk), sorghums, sudan grass, celery, green beans in the pod, beets with tops, rhubarb, oat and rye straw as such or when used as packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolus and dahlia,

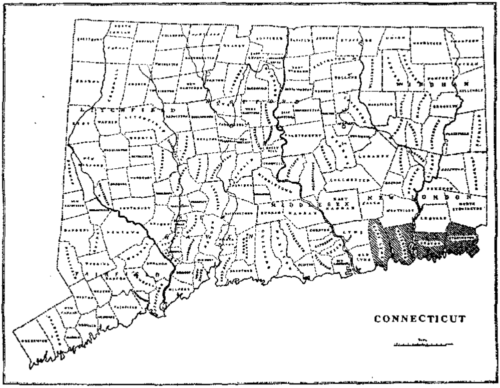

FIG. 3. Map of Connecticut; shaded area shows towns now under Federal quarantine on account of European corn borer.

except the bulbs or tubers thereof without stems, cannot be shipped interstate without inspection and certification by a Federal inspector.

Corn on the ear may be shipped within the infested area but will not be inspected and certified for shipment outside of such area. Shelled corn for seed will be examined and certified.

It is understood that a Federal inspector will soon be placed at New London or some other convenient point to take care of inspections within the quarantined area in Connecticut.

It is probable that a State quarantine will soon be placed upon this same area, to prevent the transportation of the pest in infested material to other points within the state of Connecticut.

THE JAPANESE BEETLE IN CONNECTICUT

The Japanese beetle, *Popillia japonica* Newman, was first discovered in America at Riverton, New Jersey, in 1916, and notwithstanding the enforcement of State and Federal quarantines and various other suppressive measures, it has continued to spread until it now covers a large area, including most of the states of New Jersey, northern Delaware, eastern Pennsylvania, the western end of Long Island, a portion of Westchester County, New York, and September 1, a few beetles were discovered in Stamford, Conn. The Entomologist and Assistant Entomologist Zappe visited the place on September 14, where they met Mr. Armstrong and another Federal scout, who showed them the infested yards. Four adult beetles were collected by them that day, making 18 altogether taken in Stamford. This number is too large to make it probable that the adults were brought in on shipments, trains or automobiles during the season. Had there been only two or three, such a conclusion might have been reached, but the presence of 18 seemed to indicate that the pest had been breeding there. Consequently Messrs. Zappe and Johnson visited Stamford on October 5, and made several diggings in each yard in search for grubs. None were found. The beetles discovered were in three yards on the south side of Broad Street, between Summer Street and Winthrop Street and nearly opposite the south end of Franklin Street. One beetle was found in a yard opposite on the north side of Broad Street.

Appearance of Adults

The adult beetles have a striking appearance. They vary from five-sixteenths to seven-sixteenths of an inch in length, and from three-sixteenths to nine thirty-seconds in width, or an average of three-eighths in length and one-fourth in width. The upper surfaces of head, thorax, abdomen and legs are bright and shining metallic green, with wing-covers duller and coppery-brown. The wing-covers do not project to the end of the abdomen, which shows five lateral spots on each side and two posterior spots composed of white hairs, as is shown in figure 4 and plate XIII, a. The under surface generally, including legs, is dark metallic green, and the body bears short gray hairs.

Life History

The Japanese beetle has an annual life cycle, and the adults begin to emerge about the middle of June and are usually present until the middle of October, though the period of greatest abundance extends only to about the middle of August. The females

each deposit in the soil between forty and fifty eggs, usually at the rate of four or five per day. The eggs are white, elliptical in shape, about one-sixteenth of an inch long and two-thirds as thick. They are laid separately between two and four inches beneath the surface and hatch in about two weeks. The tiny grubs are at first only one-sixteenth of an inch long, but they feed upon the

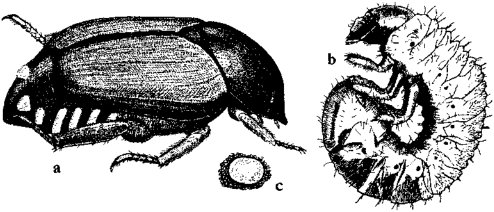

Fig. 4. The Japanese Beetle *Popillia japonica* Newman. a, adult beetle; b, grub or larva; c, egg. All enlarged about five times.

roots of grass and other vegetation and become full grown in about six weeks, when they are about an inch in length and resemble, though smaller, the common white grubs of the June beetle. They feed one or two inches beneath the surface, but on the approach of cold weather they descend to an average depth of seven inches, where they remain dormant until spring. Early in May they move upward, and just beneath the surface of the soil resume feeding and transform to pupae late in May or early in June. From two to four weeks later the adults appear.

Habits of the Beetle

About two hundred different kinds of plants, including practically all of the economic crops grown in the area, have been recorded as food plants for the Japanese beetle in New Jersey. A preference seems to be shown for apple, sweet cherry, plum, grape, blackberry, clover, soy bean, and corn. Certain shade trees are attacked, especially linden, birch, elm, horse-chestnut, sassafras, willow, and white oak. Among the ornamental shrubs, rose and althea are preferred. Many kinds of flowering plants and weeds are also attacked. Not only do the beetles feed upon the foliage, but they eat the petals of flowers, and cluster and feed upon the fruit of apple and peach trees, as shown on plate XIII, b. As many as 278 have been recorded as clustering upon a single apple.

Shallow cavities are eaten on the surface of fruits, as shown on plate XIII, c. Foliage is not wholly eaten but is skeletonized in much the same manner as by the rose chafer (see plate XIV, a).

The grubs are a serious pest in lawns, golf courses, and pastures, if they are sufficiently abundant. Wherever the infestation does not exceed one hundred larvae per square yard, as a rule no great injury follows. The injury is much more apparent in seasons of drought, because in seasons of normal or excessive rainfall the grass will make new roots before it becomes dry and brown.

Parasites

For the past seven years the Federal Bureau of Entomology has had entomologists in Asiatic countries searching for parasites that attack *Popillia japonica,* or its close allies. Though several two-winged flies and some four-winged flies have been found which attack the Japanese beetle, only one of the former, *Centeter cinerea* Ald., has become established, has extended its range, and has been recovered in the United States. This parasite lays its eggs upon the adult beetle, and the maggots kill their host in about five days.

Control Measures

The grubs in the soil may be killed by flowing upon the surface a specially prepared emulsion of carbon disulphide as is used against the grubs of the Asiatic beetle, and described on page 260.

The adult beetles may be attracted by certain chemical odors and collected in large numbers. They can then be killed by a spray formed of oleoresin or pyrethrum and a sodium oleate soap which has recently been developed in New Jersey.

Foliage and fruit may be protected by heavy applications of specially prepared arsenical mixtures, one of the most promising of which is a coated lead arsenate.

Quarantines

A Federal quarantine was placed upon the towns of Stamford and Greenwich, effective October 11, 1926. Though no beetles were found in Greenwich, an infestation was discovered in the adjacent town of Port Chester, N. Y., and in order to quarantine Stamford it was almost necessary to include Greenwich. Based on a public hearing at the Station, October 19, a State quarantine was also placed upon these two towns, becoming effective November 10. The quarantined area is shown in figure 5, and the quarantine order follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

QUARANTINE ORDER No. 11*

JAPANESE BEETLE QUARANTINE

The fact has been established by the Agricultural Experiment Station that an injurious insect known as the Japanese beetle (*Popillia japonica*) exists in the town of Stamford, Conn., and in Port Chester, N. Y.

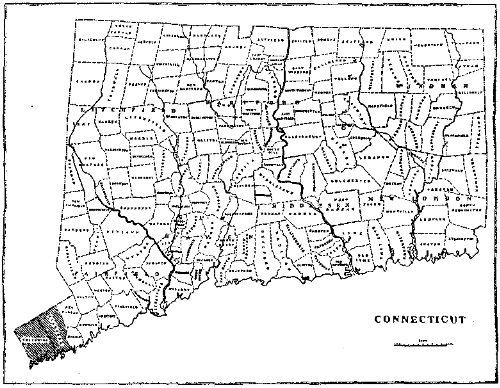

FIG. 5. Map of Connecticut; shaded area shows towns now under State and Federal quarantines on account of the Japanese beetle.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby proclaim the towns of Stamford and Greenwich to be under State quarantine, and that it shall be unlawful to move from these towns to other points within the State (1) farm, garden, and orchard products of all kinds; (2) grain and forage crops of all kinds; (3) nursery, ornamental, and greenhouse stock, and all other plants; and (4) sand, soil, earth, peat, compost, and manure, except under the conditions prescribed in the following rules and regulations supplemental to this quarantine.

* Published in Bulletin of Immediate Information, No. 56, November 10, 1926.

RULES AND REGULATIONS

Regulation 1.—Definitions.

For the purpose of these regulations, the following words, names and terms shall be construed, respectively, to mean:

1. JAPANESE BEETLE: The insect known as the Japanese beetle (*Popillia japonica* Newman) in any stage of its life cycle.
2. REGULATED AREA: Those portions of the State quarantined on account of the Japanese beetle and designated as being infested or immediately threatened with such infestation.
3. FARM PRODUCTS: Farm, garden and orchard products of all kinds, and grain and forage crops of all kinds.
4. NURSERY AND ORNAMENTAL STOCK: Nursery, ornamental and greenhouse stock and all other plants, plant roots, or portions of plants for ornamental use.
5. SAND, SOIL, EARTH, PEAT, COMPOST AND MANURE: Sand, soil, earth, peat, compost and manure of any kind, and as to either bulk movement or in connection with farm products or nursery and ornamental stock.
6. INSPECTOR: An inspector of the Connecticut Agricultural Experiment Station or the United States Department of Agriculture.

Regulation 2.—Regulated Area.

The towns of Stamford and Greenwich, in Fairfield County, and including any cities or borough within their limits.

Regulation 3.—Extension or Reduction of Regulated Area.

The area designated in Regulation 2 may be extended or reduced, as found necessary by the Connecticut Agricultural Experiment Station. Due notice of any extension or reduction of the areas affected thereby will be given in writing to the transportation companies doing business in the areas, and by publication in newspapers selected by the Connecticut Agricultural Experiment Station.

Regulation 4.—Regulation of Movement of Farm Products.

Regulation 5.—Regulation of Movement of Nursery and Ornamental Stock.

All movement of nursery and ornamental stock from the regulated area to other points outside such area, but within the State, shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision), and shall be permitted only upon full compliance with Regulations 6, 7 and 8 of this order: Provided, that such movement of nursery stock originating within or being transported through the regulated area during the period June 15 to October 15, inclusive, is prohibited to points outside such area within the State, unless protected from possible infestation in a manner or by a method approved by the inspector. All movement of nursery stock within the regulated area shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision).

Regulation 6.—Regulation of Movement of Sand, Soil, Earth, Peat, Compost and Manure.

(1) As a condition of certification of sand, soil, earth, peat, compost or manure for shipment both within the regulated area and from the regulated

area to other points within the State, all such movements of such articles shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision).

(2). The movement of any sand, soil, earth, peat, compost and manure originating within, or being transported through the regulated area to other points outside such area within the State, during the period June 15 to October 15, inclusive, is prohibited unless protected from possible infestation in a manner or by a method approved by the inspector.

Regulation 7.—Inspection, Certification and Marking a Condition of Transportation.

Each car, vehicle, box, basket, or other container of any of the articles, in process of any movement which is restricted by Regulations 4, 5 and 6, shall be plainly marked with the name and address of both consignor and consignee, and shall bear a certificate stating that the contents have been certified by the inspector, as free from the Japanese beetle: Provided, that in case of such article moved in carload or other bulk shipments the certificate shall accompany the way-bills, conductors' manifests, memoranda, or bills of lading, or in case of truck or other road vehicles, the certificate shall accompany the vehicle. Any certificate, provided for in this act, which is forged, counterfeited, altered or defaced shall be considered as invalid and any person who shall forge, counterfeit, alter or deface such certificate shall be deemed guilty of violating the requirements of the order of the Connecticut Agricultural Experiment Station applying to the Japanese beetle and shall be liable to the penalty as outlined in Chapter 107, Public Acts of 1925.

Regulation 8.—Conditions Governing Inspection and Issuance of Certificate.

Whenever it is intended to move any of the articles or materials restricted by this quarantine order from the regulated area to points outside such area within the State, application for inspection and certification shall be made as far as possible in advance of the probable date of shipment, specifying the article and quantity to be shipped, method of shipment, and the names and addresses of both consignor and consignee.

Applicants will be required to assemble the articles and materials at such points as the inspector shall designate and to place them so that they may be readily inspected. All charges for storage, cartage, and labor incident to inspection other than the services of the inspector shall be paid by the shipper.

In case of any of the articles enumerated, where absolute freedom from infestation cannot be determined by the inspector, certification will be refused.

Regulation 9.—Cleaning of Cars, Trucks, Boats, Wagons and Other Vehicles.

Railway cars, trucks, boats, wagons, and other vehicles which have been used in transporting any article covered by this quarantine within the regulated area, must be thoroughly swept and cleaned before they will be allowed to move in transportation to other points outside the regulated area within the State.

Regulation 10.—Moving or Receiving Articles in Violation of Regulations.

No person shall move or direct any other person to move any article in violation of these regulations. No person shall receive or direct any other person to receive any article moved in violation of these regulations.

Regulation 11.—Carrying or Transporting Living Japanese Beetles outside the Regulated Area.

No person shall move or carry, or direct any other person to move or carry, a living Japanese beetle to any point outside the regulated area.

This order shall take effect November 10, 1926.

W. L. SLATE, JR.,
Director, Connecticut Agricultural Experiment Station

Approved:
JOHN H. TRUMBULL,
Governor

PENALTY

Chapter 107, Public Acts of 1925, provides that "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

APPENDIX

Copies of the Appendix to Federal Quarantine No. 48 (Fifth Revision), which relates specifically to shipments of nursery or ornamental stock, and sand, soil, manure, etc., may be obtained by applying to any of the following:

Japanese Beetle Office, 42 West First Street, Mount Vernon, N. Y.
Japanese Beetle Laboratory, Riverton, N. J.
Federal Horticultural Board, Washington, D. C.

APPLICATIONS FOR INSPECTIONS

Applications for inspections and certificates or permits to move nursery or ornamental stock, sand, soil, manure, etc., should be made to the Japanese Beetle Office, 42 West First Street, Mount Vernon, N. Y.

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A CO-OPERATIVE PROJECT IN CONTROLLING THE ASIATIC BEETLE, *Anomala orientalis* Waterh.

Late in the summer of 1925, the grubs of the Asiatic beetle had injured so many lawns that numerous complaints were made to the Station. At our request, some specialists from the Federal Bureau of Entomology visited New Haven and examined the conditions. Later they submitted a report recommending that life history studies and suppressive measures be inaugurated, and that the work be done co-operatively by the State and the Bureau of Entomology. Congress was asked to appropriate funds for the purpose and finally made $5,000 available July 1, 1926. No special appropriation had been made by the State for this work but the general appropriation for the State Entomologist can be used for the study or control of any insect. Though most of this had been allotted to various projects, it was thought best, if needed, to use some of it on the Asiatic beetle. Some of the property owners expressed a willingness to contribute toward a fund to help defray the costs of the treatment, and the matter was therefore brought before the executive committee of the Edgewood Civic Association. The writer was invited to address the Association at its annual meeting November 10. Lantern slides were shown of the different stages of the insect and its injury to lawns, and a description given of its discovery in this country at New Haven, together with all available information regarding its life history, habits, injury, probable spread and means of control. The Association passed a resolution authorizing the president to appoint a committee to raise funds for control work, to be disbursed by the treasurer on vouchers approved by the Entomologist.

Bulletin of Immediate Information No. 52 was distributed to every house in the infested area. The names of residents and owners were checked carefully by the committee and a certain number assigned to each of some fifty workers who were asked to solicit and collect funds from that region. On March 25, a public meeting in the Sheridan Junior High School was addressed by Messrs. Loren B. Smith and W. E. Britton. About $4,500 was collected from owners and residents. The Association also

asked the Board of Aldermen for an appropriation of $2,500, which was granted. Thus funds were obtained from four different sources.

The advisory committee, consisting of Messrs. A. L. Quaintance and L. B. Smith of the Bureau of Entomology, and W. L. Slate, Jr., and W. E. Britton of this Station, conferred on the matter and

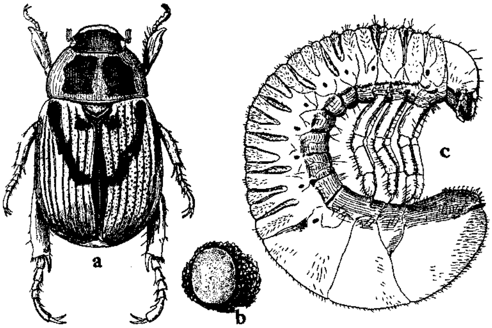

FIG. 6. The Asiatic beetle, *Anomala orientalis*. a, adult beetle. b, egg. c, grub or larva. All enlarged about five times.

decided that some very careful and thorough studies should be made on the life history and habits of the insect; that a State quarantine should be established; and that an attempt should be made to eradicate the pest.

After due notice, a public hearing was held at the Station on April 5, and a quarantine established, effective April 15, including the area between Yale Avenue, Willard Street, Forest Road, Cleveland Road, Central Avenue, and Chapel Street.

Mr. J. Peter Johnson, who had been for four years connected with the Japanese beetle work in New Jersey, was engaged to take charge of the soil treatment and to enforce the quarantine. The research work was placed in charge of Mr. R. B. Friend, assistant entomologist of this Station, and Mr. Paul A. Davis was employed to assist him.

The premises at 132 West Elm Street were leased for the season and used as headquarters. A small barn on the premises was readily adapted to serve as an office and for storage purposes. In

the rear a small insectary was built for life history investigations. This is about 10′ x 22′ and constructed in two sections, one about 10′ x 10′ and the other about 10′ x 12′, the former having a boarded roof covered with roofing felt, and the latter having a roof of hot-bed sash, which is easily removed. These two sections

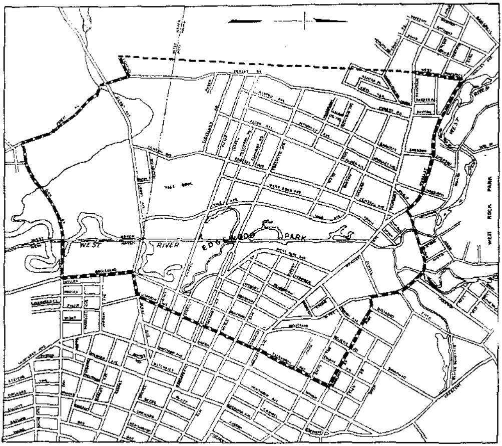

Fig. 7. Map of the Westville section of the City of New Haven. The area enclosed by the heavy dotted line is now quarantined on account of the Asiatic beetle.

are fastened together but can be readily separated for moving elsewhere at the expiration of the lease. The lower portion of the entire frame is sheathed with an artificial sheathing material and painted. The upper portion of the frame is covered with wire netting. There is a screen door in each end and another in the partition separating the two sections. The smaller section is insect tight, being covered with copper wire with a fine mesh. The larger section is covered with chicken wire with an inch mesh. A view of this insectary and a front view of the premises are shown on plate VII. This property has served very well as a place for headquarters and for insectary work. The lease has been

extended for the coming season. Good progress has been made in the investigations, but another season is necessary to complete them.

The money expended in 1926 on the Asiatic beetle project is shown, with the amount from each source, in the following table:

Source of Funds	Amount Expended
Edgewood Civic Association	$4,086.71
City of New Haven	2,471.83
Federal Bureau of Entomology	5,000.00
State of Connecticut	5,530.58
Total	$17,089.12

Of the $17,089.12, $7,884.59 was expended for labor, and $4,244.21 for emulsion. An additional charge of $1,500 for emulsion used, and not included in the figures given above, had to be paid later, chiefly from State funds.

A more detailed report on the soil treatment work has been prepared by Mr. Johnson and will be found on page 262.

The quarantine was revised in November to include additional territory, some of which was found infested by adult beetles during the summer. This present quarantined area is shown in figure 7.

Quarantine Order No. 10 became effective November 10, 1926, and is as follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

QUARANTINE ORDER No. 10
Concerning Asiatic Beetle

The fact has been determined that the Asiatic Beetle, *Anomala orientalis* Waterhouse, now occurs outside the area regulated under Quarantine Order No. 8, and it seems advisable to revise and extend the regulations to include the additional area.

Now therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby declare and order that the area bounded by Whalley Avenue from West Prospect Street eastward to Blake Street, to Ruby Street, to Moreland Road, to Ellsworth Avenue, southward to Derby Avenue, to Boulevard, to Oak Street, westward to Forest Road, northward to Florence Avenue, westward to the end of Florence Avenue (a point about 400 feet west of Forest Road), thence on a straight line northward to West Prospect Street, to Whalley Avenue, and all territory within these boundaries being partly in New Haven and partly in West Haven, shall be a regulated area out from which, until further notice, the movement of certain articles and materials will not be permitted except where inspection or treatment is prac-

ticable and permits are issued by some person or persons authorized by me to issue such permits. The restricted articles and materials are as follows:

1. Soil of any kind, including sand and loam.
2. All out-door plants with or without soil; potted plants which have been set on or in the ground out of doors between June 1 and September 30.
3. Turf or sod trimmings.
4. Lawn clippings during the period between June 15 and September 15.
5. Ground litter, weeds, manure, and compost which has lain upon the ground.
6. All cut flowers during the period between June 15 and September 15.

This order does not affect such materials originating outside of and passing through the regulated area.

This order shall take effect November 10, 1926.

W. L. Slate, Jr.,
Director, Connecticut Agricultural Experiment Station.

Approved:
John H. Trumbull,
Governor.

Penalty

Chapter 107, Public Acts of 1925, contains the following provision: "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

The foregoing regulations do not constitute an embargo, and the movement of these materials will be prohibited *only* where there is great danger of carrying the pest into uninfested territory and where inspection or treatment is considered impracticable. Permits may be issued for the movement of such materials which are not in danger of carrying the insects or which may be rendered safe by inspection or treatment.

Where to Obtain Information

Mr. J. P. Johnson has been placed in charge of enforcing this quarantine, and any one desiring to move plants and soil should make application to him. Headquarters have been established at 132 West Elm Street, telephone Colony 7215, where he may be reached during the summer months. From December 1 to April 1, the headquarters office will be closed and Mr. Johnson may be reached at the Agricultural Experiment Station, 153 Huntington Street, or by telephone, Pioneer 6450, or Liberty 1253.

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REPORT OF QUARANTINE AND CONTROL WORK FOR THE ASIATIC BEETLE DURING 1926

J. PETER JOHNSON

Organization:

The organization was employed mainly for the control work, as very little assistance was needed in enforcing the quarantine. In addition to the man in charge, one assistant, Mr. Charles E. Brown, supervised the treatment, diggings, and scouting in the field. A crew of eight men was employed to make the spring diggings, and this number was increased to 25 for the treatment work. On June 30 the force was reduced to 15 men to carry on the summer scouting. In September the force was increased, numbering 25 at the peak of the fall treatment and digging work.

Quarantine:

On April 15, 1926, a quarantine was established on account of the Asiatic beetle and the quarantined area included approximately 400 acres of land in the Westville section of New Haven. Shortly afterward copies of the Bulletins of Immediate Information No. 52 and No. 53 were left at each home within the infested area. This was done to inform the inhabitants of the quarantine and to make it immediately effective.

From time to time requests were made for the inspection of plants, soil, etc., to be shipped out from the area. In all, 28 cer-

tificates were issued certifying 2 shipments of cut flowers, 12 shrubs and evergreens, 229 plants, 963 bulbs and roots, and three excavations. The form of certificate used is as follows:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

New Haven, Conn.

CERTIFICATE OF INSPECTION FOR THE ASIATIC BEETLE

(Plants, Soil, Garden Litter, etc.)

This is to certify that I have examined or caused to be examined under Quarantine Order No. 8, as authorized by Chapter 107, Public Acts of 1925, the contents of this shipment and found it to be free from the Asiatic Beetle. It is hereby permitted to be moved, in accordance with the provisions of Quarantine Order No. 8.

Issued to ....

Address ....

Consignee .... Via ....

Street and Number ....

City .... State ....

Date ....

Shipment consists of ....

....

....

AGRICULTURAL EXPERIMENT STATION
Wm. L. Slate, Jr., *Director*
W. E. Britton, *State Entomologist*
New Haven, Conn.

J. P. JOHNSON,
In Charge of Quarantine.
Per........................

Void after.................................No. ....

The soil about the roots of twelve trees was treated with carbon disulphide emulsion for possible grub infestation, allowing their certification.

The quarantine was revised in the fall and included about 1,000 acres of new territory. In this area there is located a large sand bank from which shipments are made daily and this necessitated a new certificate for bulk shipments. A total of 28 of these certificates was issued, certifying 632 cubic yards of sand.

During the year 12 excavations were under observation as to the disposal of the soil, and three refuse collectors were approached and their co-operation secured in enforcing the quarantine.

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

New Haven, Conn.

No. ....

CERTIFICATE OF INSPECTION ON ACCOUNT OF THE ASIATIC BEETLE

Date ....192..

This is to certify that I have examined or caused to be examined, according to Quarantine Order No. 11, as authorized by Chapter 107, Public Acts of 1925, and found to be free from the Asiatic beetle, the following products:

Shipped by ....
(Name and address)

Consigned to ....
(Name and address)

Shipment consists of ....

....

via ....Car Number..............

This certificate is void after ....

J. P. JOHNSON,
In Charge of Quarantine.

Per ....

AGRICULTURAL EXPERIMENT STATION
Wm. L. Slate, Jr., *Director*
W. E. Britton, *State Entomologist*
New Haven, Conn.

Diggings:

In the spring it was thought necessary to make diggings throughout the quarantined area to determine the nature and extent of the infestation, and 1,800 diggings were made, approximately 50 feet apart. The infestation was found to be spotted, and in places there were as many as 1,000 grubs in a square yard.

Diggings were resumed in the fall, as the summer scouting work did not give all the information needed for intensive control work. The spring work was duplicated in addition to all areas in which adult beetles were found, and altogether 2,776 diggings were made.

During the season 50 or more complaints of possible grub infestations were received from outside of the area. All such complaints were investigated, and on May 17, 1926, an infestation was found at 437 Savin Avenue, West Haven, and on October 4, 1926, another infestation, one city block in extent, was found on Washington Manor Avenue, West Haven.

Because of the nature of the territory infested by the beetle, and also because of its habits, it was necessary to make nearly all the diggings in lawns. In the spring the people as a whole co-operated exceedingly well, and in the majority of cases where objections were made, the work was explained and co-operation secured. The work in the fall was to a great extent a repetition of the spring work, and very little opposition was encountered.

Emulsion:

The insecticide used in the control work was emulsified carbon disulphide. This emulsion is identical with that used to control the Japanese beetle, *Popillia japonica* Newman, and was recommended by the Japanese Beetle Laboratory. The formula is as follows:

Soap:

50 grams of lump rosin (grind), dissolve in sodium hydroxide (heat)
50 cc. of oleic acid.
135 cc. of a 7% sodium hydroxide solution.
450 cc. of water.

The soap is used at the rate of 3 parts to 7 parts of commercial carbon disulphide and this mixture is agitated until it emulsifies.

All of the emulsion was purchased from the I. P. Thomas & Son Company, Philadelphia, Pa., at a cost of $300 per ton. The majority of it was sent by freight, and the average delivery was made in eight or nine days. However, there were a few deliveries made by express, arriving in three days from Philadelphia. The emulsion arrived in perfect condition and was used immediately excepting one ton which was stored in the headquarters during the summer months. This emulsion stood up very well and was used for fall treatment.

Hose:

The standard hose used in applying the liquid was one inch in diameter. As it was known that the carbon disulphide emulsion had a deteriorating effect upon rubber hose, three grades of rubber hose were purchased in the spring in order to test their value. These were nine-ply and six-ply high-pressure hose and three-ply water hose. The nine-ply hose proved to be the poorest hose, while the three-ply water hose was the best. However, not one of the three grades was very satisfactory, as the inner lining either crumbled or separated from the hose proper, causing it to bulge and preventing the free passage of the liquid through it.

The Japanese Beetle Laboratory lent some equipment to carry on the control work, and a cheap grade of hose was included. This hose was used with great success and lasted throughout the season without any ill effects. As a result, this type of hose was purchased for the fall work and served satisfactorily.

In the spring of the year the house sill-cocks were considered as the logical source of water supply as determined by past experience with the machines. This source, however, proved to be inefficient because of the low pressure encountered, causing very much trouble in diluting the insecticide properly and permitting but a small amount of area to be treated in a day. Whenever possible, fire hydrants were used, and this enabled the machines to work at a maximum until a one-inch hose line 200 feet or more in length was needed. The friction of the water passing through the small-caliber hose would then increase to a point causing trouble identical with that encountered in the use of the sill-cocks.

During the summer, standard single-jacket, canvas-covered, rubber-lined, 2½-inch, 2-inch, and 1½-inch hose were purchased and tested. The 2½-inch hose gave the greatest flow of water and the desired results. This hose was adopted for hydrant use in the fall and enabled double the area to be treated, as compared with the spring work, in less time.

It was necessary to secure a written permit from the New Haven Water Company and the fire chiefs of New Haven and West Haven to use the fire-hydrants.

Machines:

In the latter part of April four proportioning machines were ordered from the I. P. Thomas & Son Company, Philadelphia, Pa. These machines are sold for about $70 each, with the understanding that they can be used only in applying I. P. Thomas carbon disulphide emulsion. Three machines, with the necessary equipment, were borrowed from the Japanese Beetle Laboratory for the spring work, and one for the fall work. Each machine has a capacity of 600 gallons an hour. However, because of the large area to be treated, it was thought that these machines were not

large enough to treat the area efficiently. Therefore, during the summer a larger machine was ordered and one with a capacity of 1,200 gallons an hour was made by the I. P. Thomas & Son Company and sent to us for testing. It proved to be a decided improvement and was in use during the fall.

The machines can be used in treating lawns, terraces, gardens, and ornamental plantings when proper precautions are observed. One-inch hose is used on all the machines, and a six- and a nine-inch special nozzle is used on the 600-gallon and 1,200-gallon machines respectively.

Treatment:

The insecticide used in the soil treatment for the Asiatic beetle grub is carbon disulphide emulsion, as recommended by the Japanese Beetle Laboratory. This was diluted at the rate of one quart of the emulsion in 50 gallons of water and three pints of this liquid applied to one surface square foot by the proportioning machine. This dose is effective to a depth of nearly three inches, obtaining a grub kill as high as 98% when applied properly.

During the spring season as much of the infested territory was treated as the time permitted. Every square foot in this area, including lawns, gardens, and ornamental plantings, received the treatment. Because of the nature of the surface to be treated, three men were needed to operate a machine and handle the hose, in order to minimize the possibility of damage to plants and shrubbery. In the fall, however, only lawns were treated, and two men were sufficient to operate a machine.

Seven machines, each with a capacity of 600 gallons an hour, were used during the spring treatment, and four similar ones and one of 1,200 gallons' capacity for the fall work.

Some promising results were obtained with a dose of one quart of emulsion diluted in 100 gallons of water and applied at the rate of one gallon to a square foot. Grubs were killed to a depth of eight inches, and in some instances 100% control was obtained. However, more work is necessary before any recommendation can be made.

Westville is primarily a residential section having progressive citizens who take pride in their homes, lawns and ornamental plantings. The plant world is well represented with annuals, perennials, shrubs, evergreens and deciduous stock. In the course of treatment everything received the required amount of insecticide, and very little injury resulted. Very few complaints were made concerning annuals and perennials and the injury to them was negligible. Japanese barberry proved to be somewhat susceptible to the treatment, and extreme care was exercised to prevent possible injury.

However, in considering the great number of shrubs and ever-

greens treated, the injury was practically negligible and largely due to flooding or weakening by insect attack.

Lawn injury was noted in low areas where flooding took place and in new or poor turf. As the treatment was continued into early July, it was evident that the turf became more susceptible at the approach of hot weather. The total lawn injury did not exceed 1½%, while the actual surface treated was 43.5 acres.*

Gardens were treated after the seeds had been planted and the crops were noted to grow normally. Annual plants received the treatment just after transplanting into the garden with excellent results. The perennials withstood the treatment very well and not one case of injury was reported.

The policy for controlling the Asiatic beetle during the past year was to treat every square foot possible in the infested area. Surprising co-operation was given by the residents, and only three people objected to the treatment being made during the year. However, when the object of the work was recognized by these people, they also gave their co-operation.

The infestation at 437 Savin Avenue and the area surrounding it were treated in the spring and again in the fall. A much heavier dose was applied to the area actually known to be infested. This was possible due to permission from the property owner, who was willing to sacrifice his lawn in securing a complete control. Only one beetle was found during the summer, and not one grub was discovered during the fall diggings. It is evident that very good results were obtained and the insect may have been exterminated at this place.

Treatment was made late in the fall at the Washington Manor Avenue infestation, and it is certain that favorable results were obtained considering the lateness of the season. This infestation will be treated again in the spring with extermination in view.

Scouting:

The adult beetle is more readily seen when resting than when flying. It is a rapid flyer and may skim along a few feet above the ground or high in the air. Beetles were found at night, resting on telegraph poles, on the ground, and as many as 18 were caught in a half hour flying against the glass and on the sill of a brightly illuminated store window. The territory surrounding the known infested area was thoroughly scouted, and beetles were found north, south, and east of the quarantined area. The last beetle in the field was found on August 28. There was an average of twelve men scouting daily during the entire season. The Elm City Nursery in Woodmont was scouted repeatedly during the summer and no infestations found.

* The total area including houses, garages and sidewalks would be approximately 100 acres.

Results:

In the spring there was much evidence of grub injury to lawns on Alden Avenue, Edgewood Avenue, Marvel Road, McKinley Avenue, Central Avenue, West Rock Avenue, Yale Avenue, Woodbridge Avenue, Chapel Street, Westwood Road, Elmwood Road, and West Elm Street. After the spring and fall treatments were completed, the only evidence of grub injury was on land in McKinley Avenue, which was injured prior to treatment, on Marvel Road, and on one lawn on Woodbridge Avenue. These were not treated in the fall. Thousands of grubs were killed by the treatment throughout the area, and from a control standpoint the evidence is that the work was being carried on successfully.

On August 31, 1926, an experiment was begun on Elmwood Road to control grubs by the use of acid lead arsenate ($PbHAsO_4$) in the soil. This was possible through the co-operation of Professor Schrieber in letting us have the use of a plot of turf which was infested with grubs. The arsenate of lead was applied at the rate of 1,500 pounds to the acre, and grass seed was sown in the treated soil. The seed germinated well and was growing excellently as winter set in, giving promise of a good lawn in the spring. However, some time must elapse before the results can be determined. This method is being applied successfully in the control of the Japanese beetle and is duplicated here to verify its ability to control the Asiatic beetle grub.

THE SATIN MOTH IN CONNECTICUT

Another new tree pest has appeared in Connecticut, in the satin moth, *Stilpnotia salicis* Linn., a species from Europe which was first discovered in America at Medford, Massachusetts, just north of Boston, in July, 1920. During the same month a smaller colony of this pest was found near Vancouver, B. C. The Massachusetts colony has now spread westward as far as Brookfield, Massachusetts, through Rhode Island, into eastern New Hampshire as far north as Conway, in southwestern Maine as far as Bangor, and during the early fall Federal inspectors discovered an egg-cluster in Thompson, and another in Stonington, Connecticut. The infestation in British Columbia has evidently spread, because seven towns in the State of Washington are now infested. All territory within the United States mentioned above was placed under the revised Federal quarantine No. 53, effective November 15, 1926, which prohibits the movement of all poplars and willows from the infested territory to points outside the area. The Connecticut towns quarantined on account of the satin moth are shown in figure 8.

Characteristics of the Insect

Both sexes of the moths have the appearance of being entirely white, and the peculiar satin luster gives them the name of satin moth. As a matter of fact, the eyes, head, thorax, abdomen, and a portion of the legs are black, but are so completely covered by the long white hairs that the black does not show. However, the hairs soon get rubbed off so that the abdomen and some other parts show blackish, and the antennae also appear dark. Females

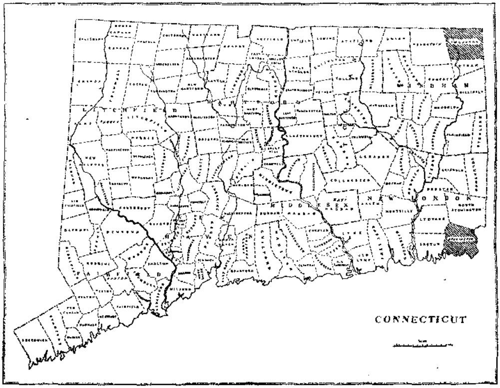

Fig. 8. Map of Connecticut; shaded areas show towns now under Federal quarantine on account of the satin moth.

have a wing-expanse of about two inches, and the males about one and three-fourths inches.

The egg-clusters are from half to three-fourths of an inch in length, usually somewhat elongated, and perhaps two-thirds as wide as long. They are very conspicuous and are covered with a glistening white substance which holds the eggs together firmly. They are usually laid on the under side of a leaf, but may be deposited on the trunk or branches of trees, or upon stones, grass, weeds, or even upon the ground, if no other convenient place is at hand.

The caterpillars vary from one and one-half to two inches in length when full grown. The head is black and the body blackish,

with finely reticulated white markings, and two narrow broken subdorsal lines between which is a row of large spots or blotches which range from square to dumb-bell-like in shape. The tubercles are reddish-brown and bear yellowish-brown hairs.

The pupa is nearly black, covered with long white or yellowish hairs, and is from three-fourths to an inch in length.

Male and female moths, caterpillars and hibernating cases are shown on plate XII, a and b.

Habits and Life History

The moths appear in July, and each female usually lays about 550 eggs, though these may not all be laid in one place; particularly if disturbed, the female moth will continue egg-laying elsewhere and frequently lays more than one egg-cluster. The eggs hatch in about fifteen days.

When the larvae have reached the third stage and are about one-fourth of an inch long, they make pockets or hibernating shelters in crevices in the bark or other favorable situations. Occasionally two or three larvae are found in one shelter, but usually each has its own individual pocket. A silk case is then made, in which the larva spends the winter. Externally this case resembles the bark of the tree so closely that it is very inconspicuous and so difficult of detection that the ordinary methods of inspection fail to reveal it. Hence inspection is not attempted in the enforcement of the quarantine; all shipments out of the area are prohibited.

In spring the larvae emerge from their winter cases and feed upon the newly expanding foliage. They reach larval maturity about July 1, and spin loose cocoons, sometimes by drawing together the edges of the leaves, sometimes in crevices of the rough bark, and again in rubbish or on the sides of buildings. In about nine days the moths emerge. There is one annual generation.

Control Measures

The egg-clusters may be saturated with creosote to kill the eggs, as is done with the gipsy moth, but only a portion of them can be so treated because they are not all accessible. Some of them are laid on the small twigs, out of reach, and climbing for them is particularly hazardous on poplars and willows on account of the weak and brittle nature of the wood.

Spraying heavily with lead arsenate as soon as the trees are in full leaf seems to be the best remedy. Burgess recommends as high as ten pounds of the poison to one hundred gallons of water, with some kind of "sticker" added. In severe infestations it may be necessary to spray again about the middle of June.

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ABUNDANCE OF *ORMENIS PRUINOSA* SAY ON IBOTA PRIVET

B. H. WALDEN

On August 5 the writer visited Bridgeport to examine the Ibota privet hedges around the houses owned by the Bridgeport Hous-

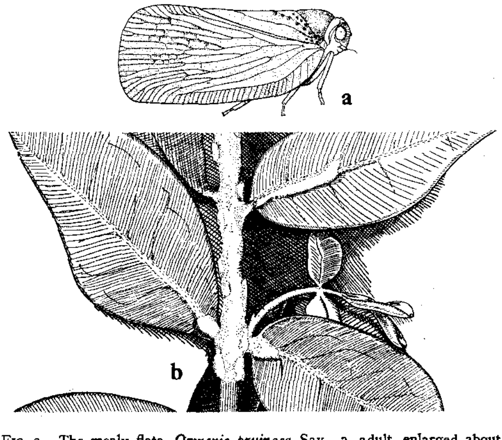

FIG. 9. The mealy flata, *Ormenis pruinosa* Say. a, adult, enlarged about seven times. b, privet twig showing wax secretion, twice natural size.

ing Company which were reported to be infested with insects. This Company owns over 700 houses, the grounds of which have

been planted with shrubbery and cared for by the Company at considerable expense. The hedges were about ten miles in extent and were found to be badly infested with the mealy flata, *Ormenis pruinosa* Say. Many of the inside branches were white with the wax-covered, last-stage nymphs, and adults were emerging on the hedges situated in sunny exposures. While the insects were very abundant there was no indication of injury to the privet, but the owners, expecting serious injury, had tried a number of contact insecticides with very little success.

The insects were so well protected by the dense foliage that it was very difficult to reach them with a spray of sufficient force to penetrate the waxy secretion with which they were covered.

In front of one of the houses a man was driving the insects out of the hedge onto the concrete walk with a strong stream of water from a garden hose. This did not drown the insects, and after the water had drained away many of them returned to the plants. It was suggested that a large number of the insects could be killed by having a second man with a stiff broom crush them on the walk before they could return to the privet.

The mealy flata was present in much smaller numbers on several other kinds of shrubs, but no injury was observed. A few plants of dahlia and salvia in one yard were badly infested and had been noticeably injured. This insect and its wax secretions are shown in figure 9.

MOSQUITO CONTROL WORK IN CONNECTICUT

Season of 1926

R. C. Botsford

Since 1915 the Director of the Connecticut Agricultural Experiment Station has had authority by act of the legislature to order mosquito breeding places eliminated when funds are provided for that purpose. Under the present law the Director shall keep in repair and maintain in non-breeding condition areas which have been ditched or treated to merit his approval and formally accepted by him for state maintenance.

Funds for maintenance and for making surveys and investigations are appropriated by the State as a special budget item of the Experiment Station. Formerly the law required that each town where work was done should be assessed for three-quarters the cost of both maintenance and new work. The Legislature of 1923 changed the law so that towns are no longer assessed, but the expense of maintenance is borne by the State. As the increased

appropriations to cover this work, as requested by the Station. have not in all cases been granted, it will be impossible for the State to assume the maintenance on any more ditched areas unless increased appropriations are granted by the General Assembly. Funds may be contributed for this work by towns, associations or individuals, and this has been done in many instances when state funds have been insufficient to produce satisfactory results in a particular locality.

In 1917 the State appropriated $5,000 to pay for one-fourth the cost of extending the work, but so little money was contributed to make up the remaining three-fourths that most of the $5,000 was unexpended. Since then the State has made no appropriation for new work.

About one-third of the total salt marsh area of Connecticut is patrolled by this Station and kept free from mosquito breeding as far as possible. The remaining two-thirds are probably breeding mosquitoes which tend to migrate to treated areas and seem to nullify the work. The maintenance of the treated areas should be continued, however, so that when the work is extended the older treated areas will be non-breeding. The cost of this work has increased, and increased appropriations are required from time to time.

Three towns have recently invested a total of about $20,000 to ditch their salt marshes in anticipation of the work being maintained permanently by this Station under the Statute.

Methods of treating breeding places of mosquitoes are described in detail in previous bulletins of this Station. The control of mosquitoes which breed in fresh water swamps, receptacles that contain rain water, and in polluted bodies of water is purely a local problem and can best be effected by a local organization headed by the health officer. These mosquitoes, which include the malaria-carrying species, are seldom found more than one-quarter of a mile from their breeding places. Mosquitoes which breed in the brackish water of the salt marshes fly long distances and may be troublesome several miles inland.

The following table gives the status of the salt marsh areas of Connecticut, and while not complete, gives all available information. The first column names towns which contain salt marsh areas; the second gives the total amount of salt marsh in acres; the third, the acres ditched; the fourth, the number of acres maintained by the State; the fifth, the amount previously expended for ditching; the sixth, the cost of labor expended in maintenance work in accepted areas of each town in 1926; and the last column is an estimate of what it would cost to complete the ditching. In most cases this estimate is high and must not be accepted as a final estimate. Figures given under each column represent a total for the State.

STATUS OF CONNECTICUT SALT MARSH AREAS, 1926

Town	Salt Marsh Areas	Salt Marsh Ditched	Maintained by State	Total Cost of Ditching	Labor, Cost of Maintenance, 1926	Labor, Cost to Complete Ditching
Greenwich	200	200	None	......	......	......
Stamford	300	300	200	$3,245.80	$175.00	......
Darien	300	300	None	3,800.00	......	......
Norwalk	600	600	None	7,500.00	......	......
Westport	400	300	None	2,514.29	......	$1,500.00
Fairfield	1,200	1,200	1,200	8,400.00	857.00	......
Bridgeport	173	....	....	......	......	3,000.00
Stratford	1,315	....	....	......	......	20,000.00
Milford	630	....	....	......	......	9,500.00
West Haven	463	222	222	Ditched with New Haven	255.25	3,500.00
New Haven	750	750	675	12,000.00	573.94	750.00
Hamden } No. Haven }	2,042	....	....	......	......	30,000.00
East Haven	482	150	50	Ditched with New Haven	59.00	6,500.00
Branford	895	578	578 }	......	878.76	4,800.00
Guilford	1,085	1,085	1,085 }	20,000.00	1,961.35	......
Madison	1,005	1,005	1,005 }	......	1,743.41	......
Clinton	785	677	None	10,000.00	......	2,000.00
Westbrook	500	220	None	3,354.62	......	3,500.00
Old Saybrook	1,373	100	None	......	......	20,000.00
Lyme	493	....	....	......	......	7,500.00
Old Lyme	1,393	....	....	......	......	21,000.00
East Lyme	424	....	....	......	......	6,500.00
Waterford	204	....	....	......	......	3,500.00
New London	34	....	....	......	......	500.00
Groton	304	50	50	1,000.00	40.07	4,000.00
Stonington	555	....	....	......	......	8,500.00
	18,005	7,737	5,065	$71,814.71	$6,553.78	$156,550.00

THE WORK BY TOWNS

NEW HAVEN

The areas under State maintenance in the towns of New Haven, East Haven, Branford, and Guilford were treated as one unit this season. Two men, with Mr. C. F. Johnson as foreman, patrolled these areas and recut and deepened thousands of feet of 10" x 24" ditches. This crew also covered the Groton area and did some work in Madison and West Haven.

At the request of the Chamber of Commerce of New Haven, a report of mosquito breeding conditions in and around New Haven was furnished by this Station, as follows:

REPORT ON ELIMINATION OF MOSQUITOES IN THE NEW HAVEN DISTRICT, JULY 20, 1926

A—*Salt Marsh Mosquitoes.*

The Salt Marsh or Migratory Mosquito breeds in stagnant, brackish water, bites both day and night, and flies several miles

from breeding places. The control is simple and effective—draining the salt marshes.

Some years ago, as a result of local interest, funds were raised sufficient to drain most of the marshes in New Haven and West Haven, some areas in East Haven, and the eastern part of Branford.

The areas in and near New Haven remaining undrained and probably furnishing New Haven with mosquitoes are as follows:

New Haven	75	acres
North Haven	310	"
Hamden	571	"
East Haven	495	"
Branford	317	"
	1,768	"

The Estimated Costs:

New Haven		
	Ditching	$ 750
	Tide gate at Middletown Avenue	2,000
	Dredging Morris Creek	3,000
		$5,750
North Haven		
	Ditching	$3,100
Hamden		
	Ditching	$5,700
East Haven		
	Ditching	$5,000
Branford		
	Ditching	$3,200

For the relief of New Haven, three projects should be undertaken at once (see figure 10).

Project No. 1.	Ditching in Hamden	571 acres, cost $5,700.
	Ditching in New Haven	75 acres, cost 750.
	Ditching in North Haven	310 acres, cost 3,100.

Tide gates on Little River at Middletown Avenue will make effective the ditching of 252 acres in New Haven and North Haven.

Project No. 2. Ditching in East Haven 495 acres, cost $5,000.

Dredging of Morris Creek will make effective the ditching of 75 acres in New Haven and about the same amount in East Haven.

Project No. 3. Ditching in Branford 317 acres, cost $3,200.

B—*Fresh Water Mosquitoes.*

This is a problem that can only be attacked by local agencies. In the towns of Fairfield and Stamford the Health Officer employs

a deputy who spends a day or two a week on mosquito work. This man inspects the whole town and either removes or causes to be removed standing water that may breed mosquitoes. There is nothing that will so quickly raise the sanitary standards of a town as an efficient, permanent policy of mosquito elimination.

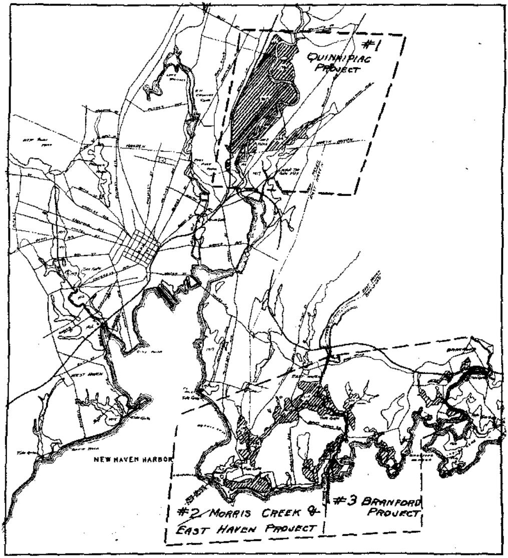

FIG. 10. Map of New Haven and vicinity; marsh areas enclosed by dotted lines need further ditching to eliminate mosquito breeding.

WEST HAVEN

The maintenance work was carried on under the same plan as in 1925, with Dr. Phelps in entire charge of the work. The town of West Haven furnished $1,000 and this Station added $220, which is the maximum amount available for the town under the present State appropriation. Not only were the areas under State care at Old Field Creek and West River kept from breeding,

but all other salt marsh breeding areas and some fresh water breeding places were eliminated by ditching. State funds alone are inadequate to properly maintain some of the West Haven areas in their present condition. The results of this season's work were reported to be highly satisfactory, and the amount actually expended was $787.75.

EAST HAVEN

About one-tenth of the salt marsh area of East Haven is under State care. This comprises two small areas, one extending from Morris Creek eastward to the road to Shell Beach, and the other the area from Momauguin westward to Caroline Creek. Ditches on these areas were cleaned and recut where necessary and mosquito breeding eliminated on these areas. The remaining salt marsh areas of the town have never been adequately ditched for mosquito elimination to be acceptable for State maintenance and are the source of the greatest mosquito nuisance.

Mosquitoes which breed in rain barrels and fresh-water swamps were much in evidence.

The new tide gates installed by the town on the East Haven River tend to restrict mosquito breeding on the large marsh east of Hemingway Avenue.

BRANFORD

The dike at Stony Creek was repaired satisfactorily but the marsh above, being flooded for several years, requires reditching. Tide gates at Hubbard's Bridge on the Branford River were patched and coaxed to last through the season, but must be rebuilt this year. No funds are available for this work. The salt marshes west of the Branford River do not come under State care.

GUILFORD

A campaign of recutting and grading ditches, which was begun in September, 1925, was continued this season, with the result that now more than three-fourths of the total footage of ditches is in perfect condition. It has been brought to the attention of this Station that some of the recut ditches have been filled for crossings and left so. This is contrary to law and we urge that this practice be discontinued immediately. The dike at Great Harbor was damaged by storms this winter.

MADISON

Patrolling of beach outlets, marshes, and recutting of ditches was continued as usual this season, with the result that little mosquito breeding occurred in this town.

The State Park and Forest Commission voted $1,000 for anti-mosquito work in the State parks. This was used at Hammonasset for reditching a large breeding area near the Hammonasset River which was formerly flooding the park with mosquitoes periodically, and also for overhauling the ditches west of the pavilion toward Webster Point.

CLINTON

On June 1, 1926, the town of Clinton entered into contract with Mr. Edwin M. Skinner of Bloomfield, N. J., to ditch five-sixths of the salt marshes of the town under State supervision. Funds were not sufficient to complete the whole area at this time.

Legal notices were sent to all record marsh owners and every effort was made to cause as little inconvenience as possible to the marsh owners and yet obtain the desired results. Ditches were placed on boundaries wherever possible and intermediate ditches placed where necessary. The work of ditching will be completed before the next mosquito breeding season, and the maintenance work will start just as soon as the funds, which have been requested, are received.

WESTBROOK

The town of Westbrook appropriated $3,500 to complete the ditching of the salt marshes of the town. This work is being done under State supervision and will be completed next season. Funds for maintenance during the following biennium have been requested according to statute.

GROTON

Some new ditches were installed in this area to improve drainage, and the old ditches were cleaned and graded where necessary to prevent possible mosquito breeding.

FAIRFIELD

Where possible, salt marshes were burned over to facilitate the patrol work and cleaning. Altogether, 17,832 feet of new 10" x 24" ditches were cut to improve drainage, and 35,942 feet of old ditches recut and graded. The town of Fairfield continued its fresh water work and installed nearly 800 feet of pipe drains. Swamps which could not be drained were oiled every ten days and 100 gallons of crank case oil at four cents a gallon were used.

The funds available for work in Fairfield this season were as follows:

Appropriations, Town	$3,301.15
" State	857.00
Fairfield Improvement Association, Inc.	146.05
DuPont Fabricoid Company	250.00
Mr. and Mrs. M. Neary	125.00
Total	$4,679.20

Mosquito control work was reported very successful this season, and at the town meeting on October 5 it was unanimously voted to appropriate $3,000 for the season of 1927.

WESTPORT

Funds sufficient to ditch all salt marshes in the town of Westport were made available, and the Connecticut Agricultural Experiment Station was requested to supervise the work. Ditching was started on October 15, 1926, and continued until about December 1, when a heavy fall of snow prevented further work. The work will be completed next season, and State maintenance will start when funds are made available. This ditching job so far has progressed very satisfactorily, due to the co-operation of the property owners.

STAMFORD

The salt marshes were burned over early in the spring wherever possible. About 9,873 feet of new 10" x 24" ditches were cut and 21,636 feet of old ditches recut and graded. About fifty feet of drain pipes were installed and 450 gallons of oil used to spray mosquito breeding pools which could not be drained.

This work was done by experienced men from Fairfield, and funds were furnished as follows:

Appropriation, City of Stamford	$210.35
" State	175.00
Shippan Point Association	550.00
Scofield Estate	48.50
	$983.85

Treatment of fresh water swamps was continued as usual by the City of Stamford.

MISCELLANEOUS INSECT NOTES

Leaf Roller on Hickory: Leaf rollers on hickory were collected near the Station and brought to the laboratory June 16. On June 23, an adult moth emerged and proved to be *Archips rosana* Linn. In 1913, this insect was rather abundant on certain privet hedges in New Haven, rolling the leaves of the terminal shoots. It was also observed in 1915.

Dingy Cutworm Injuring Apple Trees: On May 14, 1926, Mr. Zappe collected at Wallingford some cutworms which had eaten the buds from grafts in small apple trees which had been planted in the orchard two or three years. The owner top-worked these trees and in most cases the injured grafts were not more than three feet from the ground. In September, some adults emerged and were identified as the moths of the dingy cutworm, *Feltia subgothica* Haworth.

Spruce Scale: Specimens of the spruce scale, *Physokermes piceae* Schrank, were received from Woodlawn, N. Y., February 9, 1926. These insects are globular and are usually clustered in groups surrounding the bases of the twigs and resembling buds. They are rigid, from 1.5-3 mm. in diameter, and chestnut-brown in color. This species has been recorded from Connecticut.

Beets Attacked by Greenhouse Leaf-Tyer: On September 23, 1925, Mr. E. M. Stoddard of the Botany Department brought to the laboratory some Lepidopterous larvae which he found feeding upon the leaves of beets in his garden in Hamden. On March 1, 1926, one adult emerged, and proved to be the greenhouse leaf-tyer, *Phlyctaenia ferrugalis* Hubn. This insect has often caused injury to various plants under glass and outside. Spraying with lead arsenate may be practiced with success where the foliage is not to be used for human food.

European Grain Beetle in Connecticut: The European grain beetle, *Cathartus advena* Waltl. occurs in Connecticut and two specimens are now in the Station collection. One of them was collected in Fairfield, May 10, 1921, by M. P. Zappe, and the other in Cornwall, November 29, 1922, by K. F. Chamberlain. The former specimen was identified by Mr. H. C. Fall. This species often attacks stored grain and other plant products, especially where decay has set in. It is also found under the bark of dead trees. It belongs to the family Cucujidae.

Japanese Scale Insect: In the Report of this Station for 1915, page 139, is a record of the occurrence in Connecticut of a Japanese scale, *Leucaspis japonica* Cockerell, which had been collected on silver and Norway maple and privet in Greenwich. On December 14, this insect was again received from Greenwich on

silver and Norway maples; it is said to have caused considerable injury in that section of the town known as Belle Haven. Some of the infested trees have been sprayed each year for the past two years with a miscible oil (1-15) which considerably reduced the infestation, but it was not completely effective because in late fall there was a moderate number of living scales on the trees. Further field tests must be made for the control of this insect before we shall be in a position to make recommendations concerning treatment.

Flight of Cotton Moth: For a period of two or three weeks in late September and early October, there were moderate numbers of the cotton moth, *Alabama argillacea* Hubn. resting on the store windows along Chapel Street in New Haven, and Mr. J. L. Rogers observed similar conditions in Bridgeport. On October 8, eight specimens of this moth were received from Waterbury. The invasion seems to have been rather general. Similar flights of moths varying in abundance have been recorded in the Reports of this Station for 1911, page 339; 1912, page 217; 1919, page 202; and 1923, page 313. The larvae of this moth are known to feed only on cotton, and the moths must have migrated from the southern states where cotton is grown. It is believed that the species does not winter anywhere in the United States, but comes in each year from the West Indies, Mexico, or other southern countries.

Persimmon Psyllid in Connecticut: On July 17, some insects were received from Dr. Robert T. Morris, Stamford, on persimmon twigs. The leaves were curled at the edges, and the immature psyllids lived under the curled margins. One adult developed and proved to be the persimmon psyllid, *Trioza diospyri* Ashm., a species common on persimmon trees in the South, though not before recorded as occurring in Connecticut. Dr. Morris regards this insect as a destructive pest of cultivated Japanese, American, and hybrid persimmons, and states that the native persimmon is not often attacked. He further states that either the adults or young attack and destroy the terminal buds. Though his cultivated varieties have received several sprayings with tobacco and the infestation has been reduced somewhat, the insect is still sufficiently destructive to halt the growth on many branches. Probably the best chance of control lies in an application of nicotine sulphate solution and soap soon after the eggs hatch and before the leaves are curled.

European Pine Shoot Moth: The presence of this insect at Ridgefield was recorded in the Report of this Station for 1923, page 311, and for a longer period the pest has been known to be present on Long Island and in Westchester County, New York, adjoining Connecticut. This insect has been cited in literature

under the name of *Evetria buoliana,* but is now known as *Rhyacionia buoliana* Schiff. In 1925, Messrs. Filley and Zappe observed the characteristic crooked growth or "bayonet shoots" on red or Norway pines growing in Greenwich and also in the plantations of the Bridgeport Hydraulic Company along the highway between Bridgeport and Danbury, probably in the town of Easton. The entomologist visited these areas in company with Mr. Filley, on July 26. Although they saw some of the crooked growth, caused by the larvae killing the buds of the leaders, they were pleasantly surprised to see how readily the red pine adapts itself and recovers from such injuries. In several cases where all buds in a cluster had been killed, adventitious buds had formed, and one of these, if not injured, would replace the leader with almost no deformation. Further observations will be made regarding the injuries caused by this insect.

Silky Robber Fly: In making a small vegetable garden on an open hillside at Mount Carmel during May, the writer observed dozens of white larvae in the soil. These were evidently Dip-

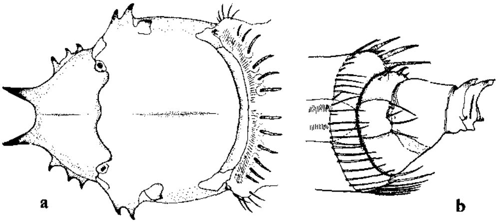

FIG. 11. Pupa of the silky robber fly, *Asilus sericeus* Say. a, dorsal view of head and thorax; enlarged about eight times. b, lateral view of posterior extremity; enlarged about fifteen times.

terous larvae and were nearly an inch in length and of nearly uniform thickness, though tapering slightly, and bluntly pointed at both ends. A row of stiff bristles or spines pointed backward on the dorsum of each segment. Material was gathered and placed in the insectary. In a day or two some of these larvae transformed to golden brown pupae which were much smaller than the larvae. Though the larvae were nearly an inch in length, the pupae were between half and five-eighths of an inch. On the head are borne two rather prominent teeth with a three-toothed lateral projection and the front and lateral margins of the thorax

are peculiarly toothed and scalloped, as shown in figure 11. The pupa has been described in detail by Malloch.[1] On May 29, four adults emerged and proved to be the silky robber fly, *Asilus sericeus* Say, a species with head, thorax, and body together totaling about an inch in length. The general color is golden brown, with darker brown eyes, median stripe on thorax and bases of abdominal segments. The wings are of the same color, with darker marginal cells. The legs are golden brown with darker femora; under surface, legs golden brown with dark brown thorax and abdomen. Larva, pupa and adult are shown on plate XVI. Apparently little is known regarding the larval habits of the silky robber fly. Malloch states that "the habits of the larvae are unknown to me."[2] He also states that "*Asilus notatus* and *Leptogaster flavipes* I have found only in or near woods, and especially in or under decaying wood, and it is very probable that they confine themselves to attacks upon species that are found in such situations—Tenebrionidae and Cerambycidae particularly."[3]

All Asilid larvae are supposedly predaceous, feeding upon other insect larvae. Williston states that "young larvae sometimes bore their way completely within the bodies of other larvae, remaining there till their food is wholly consumed. Often the larvae are found free in the earth, however, where their transformations occur. The eggs are laid about grass stems, or in crevices of decaying logs and trees infested by the larvae of other insects."[4]

Mr. E. L. Bell has recorded his observations on the adult of this fly as a captor of butterflies on the wing. In one case the common pearl crescent, *Phyciodes tharos* Drury, was captured.[5] In another instance the victim was the silver-spotted skipper, *Epargyreus tityrus* Fabr.[6]

[1] Bull. Ill. State Lab. Nat. Hist., Vol. xii, page 386, 1917.
[2] *Ibid.*, page 387.
[3] *Ibid.*, page 374.
[4] Manual of N. A Diptera (3d ed.), page 196, 1908
[5] Bull. Brook. Ent. Soc., Vol. xvi, page 96, 1921.
[6] Jour. N. Y. Ent. Soc., Vol. xxxii, page 219, 1924.

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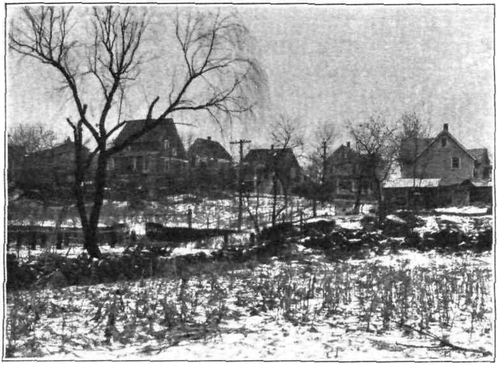
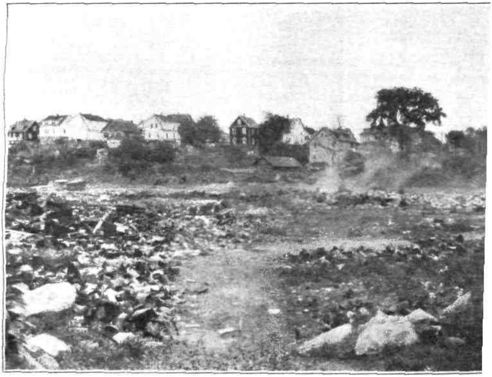


a. General view of gipsy moth infestation discovered in East Port Chester, Greenwich.

b. Close-up view of tree shown above, with stone of wall upturned to show egg-clusters.

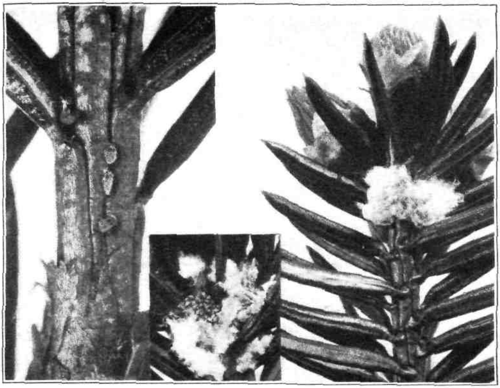
GIPSY MOTH.

a. View showing sprayed trees in Greenwich infestation.

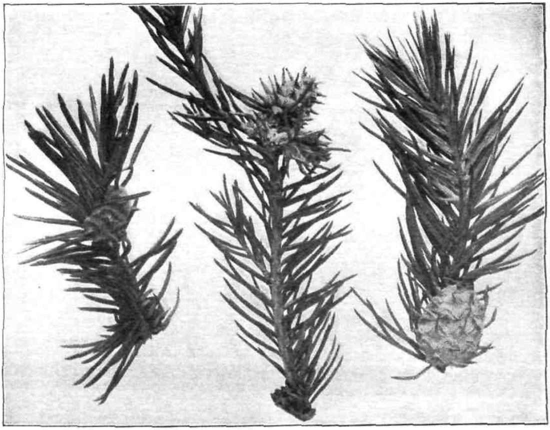


b. View of "dump" near Greenwich infestation.

GIPSY MOTH.

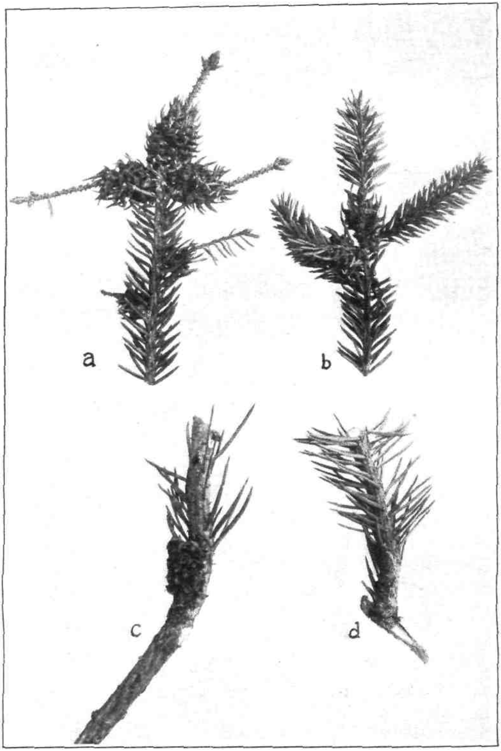


a. Overwintering females of *Adelges abietis* Linn.; left, appearance of females during winter, enlarged ten times; right, appearance of females at time of oviposition, enlarged four times; center, waxy threads removed to show eggs, enlarged four times.



b. Partially developed galls of *Adelges abietis* Linn., on Norway spruce, natural size.

PLATE IV.



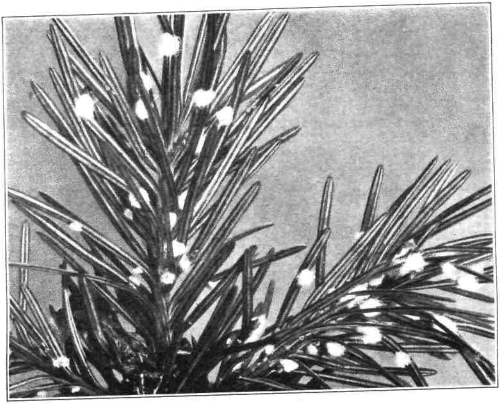
Galls of *Adelges abietis* Linn. on twigs of Norway spruce, natural size.

SPRUCE GALL APHIDS.

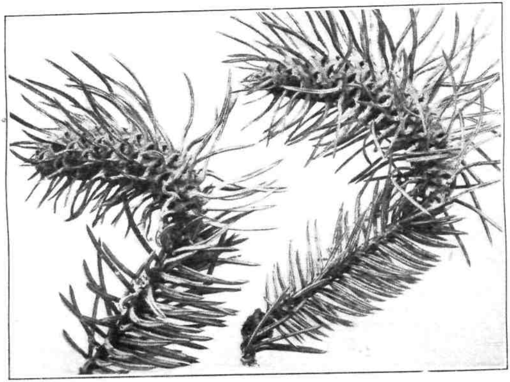
Young Norway spruce covered with galls of *Adelges abietis* Linn.

SPRUCE GALL APHIDS.

PLATE VI.



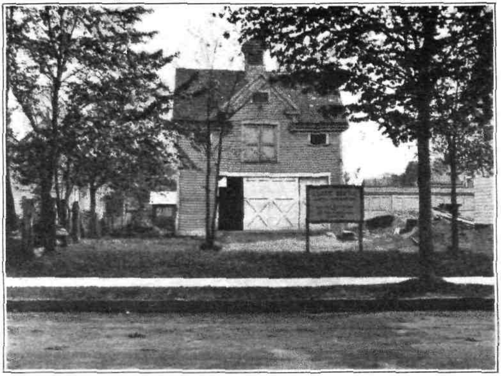
a. *Gillettea cooleyi* var. *coweni* Gillette, on Douglas fir, twice enlarged.



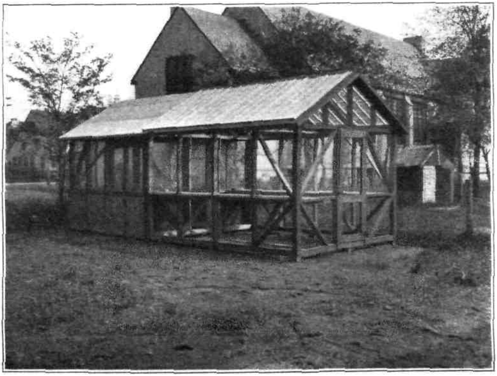
b. Galls of *Gillettea cooleyi* Gillette, on blue spruce, natural size.

SPRUCE GALL APHIDS.

PLATE VII.



a. View of barn rented as headquarters, 132 West Elm Street; end of insectary may be seen in the rear at left.



b. Insectary built for life history studies, at 132 West Elm Street.

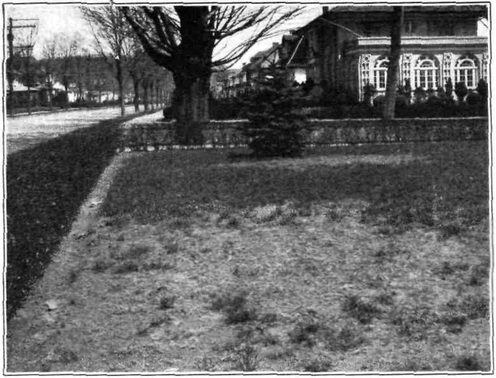
ASIATIC BEETLE WORK.

PLATE VIII.

a. View in nursery where men are making diggings in search for grubs; none were found here.

b. Making a digging in a lawn.

ASIATIC BEETLE WORK.

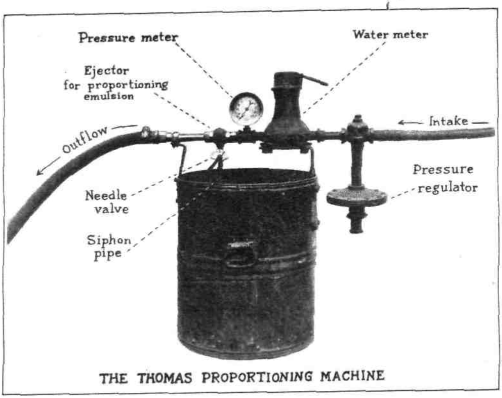


a. Lawn on McKinley Avenue, showing injury by grubs.

b. Lawn on Edgewood Avenue showing spots injured by grubs.

ASIATIC BEETLE WORK.

PLATE X.



a. View of Thomas Proportioning Machine.

b. Nozzle discharging emulsion upon a lawn.

ASIATIC BEETLE WORK.

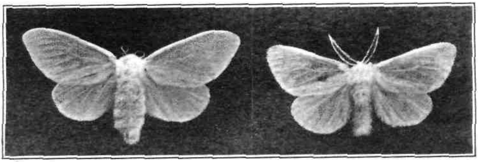
a. Method of applying emulsion to lawns.

b. Method of treating flower beds.

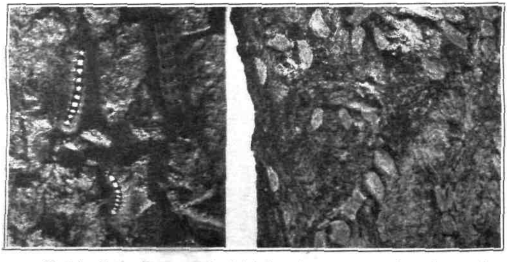
ASIATIC BEETLE WORK.

PLATE XII.

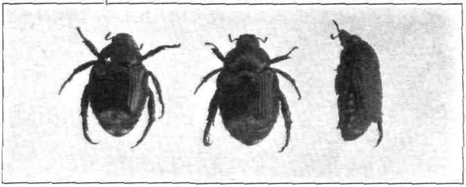
a. Method of treating soil around roots of trees to kill grubs of Asiatic beetle.



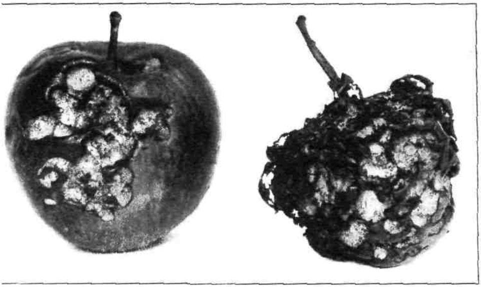
b. Female and male satin moths, natural size (After Burgess and *Crossman, Dept. Bull. 1469 U. S. Dept. of Agriculture*).



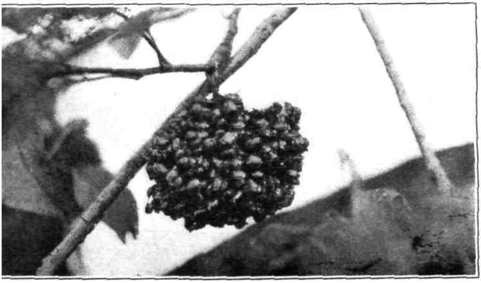
c. (Left) Caterpillars, and (right) winter cases of satin - moth



a. Japanese beetle, *Popillia japonica* Newm.; adults twice enlarged.



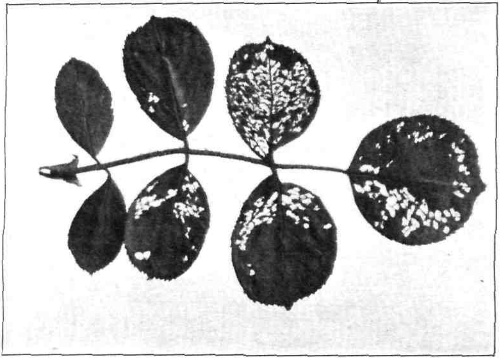
b. Apples injured by Japanese beetles (After Jap. Beetle Lab. U. S. Dept. of Agriculture).



c. Japanese beetles clustered on fruit (After Jap. Beetle Lab., U. S. Dept. of Agriculture).

JAPANESE BEETLE.

PLATE XIV.

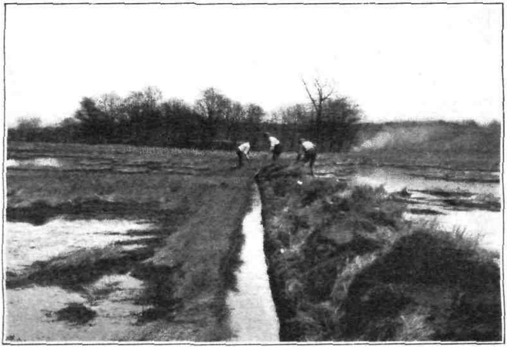


a. Rose leaves eaten by Japanese beetles, natural size.

b. View in a Stamford back yard where Japanese beetles were found.

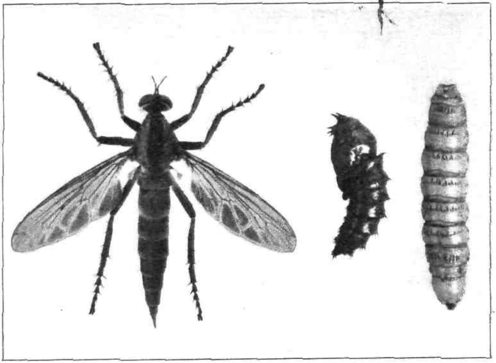
JAPANESE BEETLE.

a. Dike at Leetes Island, Guilford, damaged by storms.

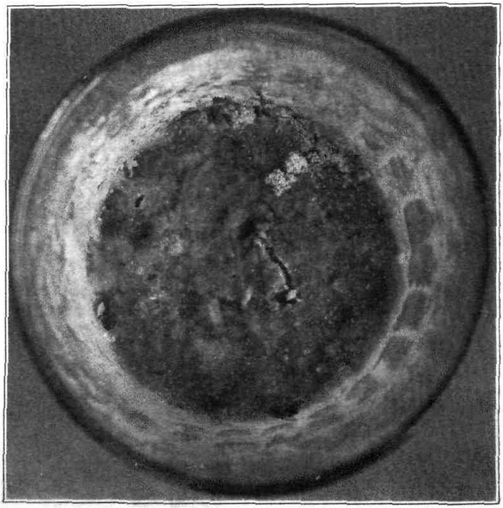


b. Cleaning ditches, New Haven.

MOSQUITO CONTROL WORK.



a. Silky robber fly, *Asilus sericeus* Say. Adult at left, larva at right, pupa case in center, all twice enlarged.



b. Artificial mixture showing tunnel just beneath the surface, and

BULLETIN 286 APRIL, 1927

Connecticut Agricultural Experiment Station

New Haven, Connecticut

The Thirty-First Report on

FOOD PRODUCTS

and the Nineteenth Report on

DRUG PRODUCTS

1926

Part I

Tables of Analyses of Foods

By
E. M. BAILEY

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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as of

April, 1927

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THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

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The Thirty-First Report on Food Products and the Nineteenth Report on Drug Products

PART I

Analyses of Common Foods and Special Foods

E. M. BAILEY

For many years the Station has given considerable attention to the analysis of special foods offered for use in the dietary of the diabetic patient. From time to time such analyses have been summarized in special bulletins,[1] the first in 1906 and others in 1913 and 1919. The purpose of such work is solely to furnish reliable information as to the composition of these foods for the guidance of physicians, dietitians and others interested in diabetes and in diabetic treatment. No particular foods are recommended; no advice is given in bulletins or otherwise as to the formulation of dietaries; and the inclusion of products in these compilations does not necessarily mean that such products are adapted to the purpose for which they are offered.

In all methods of treatment of diabetes careful regulation of diet is of paramount importance. The discovery of insulin has revolutionized treatment of this disease; it permits the patient to take more food, but proper choice of food and regulation of its quantity are still necessary.

Successful diets for diabetics may be formulated by proper selection of common foods quite as well as by the use of special foods although there can be no objection to such special foods when offered without misrepresentation. Many of them, no doubt, serve useful purposes. Such special products are expensive in most cases, however, and many physicians hesitate to encourage their use for that reason. Because of this, and also because of the increased tolerance which the use of insulin affords, the utilization of common foods is of increasing interest to the physician and to the patient. It seems desirable, therefore, also to include in the present bulletin analyses of some of these foods. For the most part such analyses are taken from well-known sources and they are already widely quoted.

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[1] Conn. Agr. Exp. Sta., 11th Report on Food Products, pp. 153-165, 1906.
" " " " 18th " " " " 1913.
" " " " 24th " " " " Part II, 1919.

Official Definition of "Diabetic" Food Revoked

There is no longer any Federal definition of a "diabetic" food.[2] Since such products are offered as dietetic aids in the control or mitigation of disease they are regarded by food control officials as therapeutic agents rather than as foods and more properly regulated under the provisions of the Food and Drugs Act which refer to drugs.

The term "diabetic" as applied to this type of foods has been much abused in the past; many foods which differ but little from common foods of the same class have been designated by that term. Moreover it may be true that some patients have been led to believe that foods bearing the qualification "diabetic" are curative or mitigative in themselves rather than merely dietetic adjuncts. For these reasons regulatory officials are inclined to discourage the use of the term "diabetic" as a part of the name of these special foods and in explanatory literature concerning them.

Rôle of the Nutrients and the Significance of Terms Used in Analyses.

The conventional analysis of foods shows their composition in terms of the proximate constituent groups, viz., moisture, ash, protein, carbohydrate and fat. Nearly all foods contain some water, the proportion varying from ten per cent or less in air-dry cereals for example, up to ninety per cent or more in fresh fruits and vegetables. Ash represents iron, calcium, phosphorus, and other mineral elements. Protein represents nitrogenous materials. Protein is not determined as such, but is always estimated from the nitrogen in the food. For this estimation nitrogen is generally multiplied by the factor 6.25, the assumption being that protein contains 16 per ceut of nitrogen. But proteins vary in their nitrogen content and other factors are more accurate in certain cases; for example 6.38 is more nearly correct for casein and 5.70 for gluten. Food analyses do not take into account the differences in quality of various proteins; and, moreover, nitrogenous material of a non-protein character may be reckoned as protein.

In the process of digestion protein is broken down ultimately into a large number of simpler substances called amino-acids. The nitrogenous part of these protein derivatives is eliminated chiefly as urea; the non-nitrogenous part is either burned as fuel or converted into carbohydrate and, directly or indirectly, into fat.

[2] Revoked by U. S. Dept. Agr., Food Inspection Decision 199.

In diabetes this protein-derived carbohydrate may be excreted just as in the case of carbohydrate ingested as such.

Carbohydrate includes sugar, starch, dextrin and related nitrogen-free substances. Fiber also belongs to the carbohydrate group but it is not regarded as a nutrient in human digestion although it may be a mechanical aid to the digestive process. The carbohydrate group, sometimes called nitrogen-free extract, is generally, and a part of it almost always, estimated by calculation; the difference between 100 per cent and the sum of the percentages of determined items is taken as the percentage of this nutrient group.

The dietitian frequently wishes to know how much of the carbohydrate is "available" in digestion. This question cannot be answered without reservations. That portion which is composed of starch, sucrose and other sugars and dextrin is assimilable; the remainder, consisting of hemicellulose complexes, is of doubtful or undetermined availability. Joslin[1] has discussed some of the commoner carbohydrates from the standpoint of their influence upon the metabolism in diabetes. Among the hemicelluloses pentosans and galactans are conspicuous. Pentosans are the principal constituents of vegetable gums, the fibrous tissues of vegetables and the outer coats of cereal grains. Galactans occur in small quantities in many plants and in larger amounts in leguminous seeds. The digestibility of some of these substances as they occur in lichens and certain algae has been investigated by Schwartz[2] who observed that pentosans may very largely disappear from the alimentary tract, probably through the agency of bacterial activity; but that galactans exhibit a high degree of resistance to bacterial decomposition. Whether pentosans serve as true nutrients however was not determined. In general, hemicelluloses do not appear to be important sources of energy in nutrition.

Fat includes besides true fat and oil other substances soluble in ether. Mineral oil, which is used to a considerable extent in the preparation of low calorie products, is included as fat although, of course, it is unassimilable.

Under normal conditions fats are oxidized in the body to carbon dioxide and water, but in this change carbohydrate plays an important part. In the treatment of diabetes limitation of carbohydrate is a necessary expedient, but it is a common observation that on a carbohydrate-free diet, or one in which fat has been increased to compensate for the withdrawal of carbohydrate, there may be an incomplete oxidation of fat as indicated by the climation of β-oxybutyric acid, acetoacetic acid and acetone; in other words, a condition of acidosis or ketosis results. Investiga-

[1] Treatment of Diabetes Mellitus, 3d edition, p. 427.
[2] Conn. Acad. Arts and Sci., 16, pp. 247-382, 1911.

tion has shown that certain nutrients interfere with the complete oxidation of fats while others favor that process, and this observation has resulted in a classification of the nutrients on this basis. Fats favor the production of acetone bodies and hence are regarded as ketogenic in their action; carbohydrates tend to inhibit the formation of acetone bodies and are therefore antiketogenic nutrients. Proteins to the extent in which they contain sugar-yielding amino-acids are antiketogenic; but with respect to other amino-acids present they are ketogenic.

This relation between ketogenic and antiketogenic nutrients is called the ketogenic ratio (K/A) and is of practical usefulness in dietary studies. Ladd and Palmer[1] have suggested a convenient formula for calculating this ratio when only the composition of the diet is known:

$$\frac{K}{A} = \frac{\text{gram Fat}}{(0.58 \times \text{gram Protein} + \text{gram Carbohydrate})}$$

When this ratio exceeds 4:1 ketosis is likely to occur according to these investigators.

In calculating calories the entire carbohydrate group (other than fiber) has been included. It is clear that our information is not complete enough to justify an attempt to include only that part of the carbohydrate which may be called "available." In certain products in which the fat was found, or known, to be largely mineral oil, and in a few other instances where the carbohydrate probably consists largely of hemicellulose complexes, calorie values have been omitted.

Tables of Analyses.

The analyses given in Table I are of some common foods and are taken largely from the classic work of Atwater and Bryant.[2] Many, however, are taken from various bulletins of this Station and some are from other sources.

The analyses in Table II are taken from a previous bulletin of this Station issued in 1919 with such additions as have been made since that time up to and including 1926.

Acknowledgment is due to Dr. E. P. Joslin who has called our attention to new or unusual products and has frequently obtained samples; also to Professor Lafayette B. Mendel for similar courtesies and for counsel and suggestions from time to time; to the chemists of the department staff for analyses, chiefly to Mr. Shepard who is responsible for the examination of so-called diabetic and special foods; and to Miss Bacon who has assisted largely in the work of compilation.

[1] Am. Jour. Med. Sci., 166, 157, 1923.
[2] U. S. Dept. Agr., Office of Experiment Stations, Bull. 28.

TABLE I. ANALYSES OF COMMON FOODS.

(Analyses are of edible portion unless otherwise stated)

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Meat and Meat Products.							
Beef, fresh:	%	%	%	%	%	%	
Brisket, medium fat	54.6	0.9	15.8	....	....	28.5	319
Chuck rib	66.8	1.0	19.0	....	....	13.4	197
Flank	59.3	0.9	19.6	....	....	21.1	268
Loin	61.3	1.0	19.0	....	....	19.1	247
Neck	66.3	1.0	20.7	....	....	12.7	197
Plate	56.3	0.8	16.8	....	....	26.9	309
Ribs	57.0	0.9	17.8	....	....	24.6	293
Round	67.8	1.1	20.9	....	....	10.6	179
Rump, lean	65.7	1.0	20.9	....	....	13.7	207
Shank, fore	70.3	0.9	21.4	....	....	8.1	158
hind	69.6	1.0	21.7	....	....	8.7	165
Shoulder and clod	68.9	1.1	20.0	....	....	10.3	173
Soup Stock	89.1	3.6	5.8	....	....	1.5	36
Miscellaneous cuts, free from visible fat	73.8	1.2	22.4	....	....	2.9	116
Beef organs, fresh:							
Brain	80.6	1.1	8.8	....	....	9.3	119
Heart	62.6	1.0	16.0	....	....	20.4	248
Kidney, as purchased	6.31	1.0	13.7	....	0.4	1.9	73
Liver, as purchased	65.6	1.3	20.2	....	2.5[1]	3.1	119
Lungs, as purchased	79.7	1.0	16.4	....	....	3.2	94
Marrow, as purchased	3.3	1.3	2.2	....	....	92.8	844
Sweet breads, as purchased	70.9	1.6	16.8	....	....	12.1	176
Suet, as purchased	13.7	0.3	4.7	....	....	81.8	755
Tongue	70.8	1.0	18.9	....	....	9.2	158
Beef, cooked:							
Roast	....	....	22.3	....	....	28.6	347
Steak, round, fat partly removed	63.0	1.8	27.6	....	....	7.7	180
sirloin	63.7	1.4	23.9	....	....	10.2	187
tenderloin	54.8	1.2	23.5	....	....	20.4	278
Beef, canned:							
Corned	56.4	4.7[3]	26.6	....	....	11.4	200
Dried and smoked	47.4	12.5[2]	32.6	....	....	7.5	198
Kidney, stewed	71.9	2.5	18.4	....	2.1	5.1	128
Luncheon	52.9	4.8	27.6	....	....	15.9	254
Roast	58.9	1.3	25.9	....	....	14.8	237
Sweetbreads	69.0	2.0	20.2	....	....	9.5	166
Tongue, ground	49.9	4.0	21.4	....	....	25.1	312
whole	51.3	4.0	19.5	....	....	23.2	287
Tripe	74.6	0.5	16.8	....	....	8.5	144

[1] Largely, or in part, glycogen. [2] Average 3.4 per cent salt (sodium chloride).
[3] Average 9.7 per cent salt (sodium chloride).

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Meat and Meat Products—Continued.							
Beef, corned and pickled:	%	%	%	%	%	%	
Corned beef, all analyses	53.6	4.9	15.6	....	....	26.2	298
Spiced, rolled	30.0	6.8	12.0	....	....	51.4	511
Tongue, pickled	62.3	4.7	12.8	....	....	20.5	236
Tripe	86.5	0.3	11.7	....	0.2	1.2	58
Beef, dried, salted and smoked	54.3	9.1	30.0	....	....	6.5	179
Veal, fresh:							
Breast	68.2	1.0	20.3	....	....	11.0	180
Chuck	73.8	1.0	19.7	....	....	5.8	131
Flank, as purchased	66.9	1.0	20.1	....	....	12.7	195
Leg	71.7	1.1	20.7	....	....	6.7	143
Leg cutlets	70.7	1.1	20.3	....	....	7.7	151
Loin	69.5	1.1	19.9	....	....	10.0	170
Rib	69.8	1.1	20.2	....	....	9.4	165
Rump	62.6	1.1	19.8	....	....	16.2	225
Shoulder	73.4	1.3	20.7	....	....	4.6	124
Veal organs, fresh:							
Heart, as purchased	73.2	1.0	16.8	....	....	9.6	154
Kidney, as purchased	75.8	1.3	16.9	....	....	6.4	125
Liver, as purchased	73.0	1.3	19.0	....	....	5.3	124
Lungs, as purchased	76.8	1.1	17.1	....	....	5.0	113
Mutton, fresh:							
Chuck	48.2	0.8	14.6	....	....	36.8	390
Leg, hind, medium fat	62.8	1.0	18.5	....	....	18.0	236
Loin	50.2	0.8	16.0	....	....	33.1	362
Shoulder, medium fat	61.9	0.9	17.7	....	....	19.9	250
Mutton organs, fresh:							
Heart, as purchased	69.5	0.9	16.9	....	....	12.6	181
Kidney, as purchased	78.7	1.3	16.5	....	....	3.2	95
Liver, as purchased	61.2	1.7	23.1	....	5.0[1]	9.0	193
Lungs, as purchased	75.9	1.2	20.2	....	....	2.8	106
Mutton, cooked:							
Leg roast	50.9	1.2	25.0	....	....	22.6	303
Mutton, canned:							
Corned	45.8	4.2	28.8	....	....	22.8	320
Tongue	47.6	4.8	24.4	....	....	24.0	314
Lamb, fresh:							
Breast	56.2	1.0	19.1	....	....	23.6	289
Leg, hind, medium fat	63.9	1.1	19.2	....	....	16.5	225
Loin	53.1	1.0	18.7	....	....	28.3	330
Shoulder	51.8	1.0	18.1	....	....	29.7	340
Lamb, cooked:							
Chops, broiled	47.6	1.3	21.7	....	....	29.9	356
Leg, roast	67.1	0.8	19.7	....	....	12.7	193

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Meat and Meat Products—Concluded.							
Lamb, canned:	%	%	%	%	%	%	
Tongue, spiced, cooked	67.4	0.5	13.9	....	....	17.8	216
Pork, fresh:							
Ham, lean	60.0	1.3	25.0	....	....	14.4	230
Ham, medium fat	53.9	0.8	15.3	....	....	28.9	321
Head cheese	43.3	3.3	19.5	....	....	33.8	382
Loin (chops), lean	60.3	1.0	20.3	....	....	19.0	252
Loin (chops), medium fat	52.0	1.0	16.6	....	....	30.1	337
Shoulder	51.2	0.8	13.3	....	....	34.2	361
Side, fat	29.4	0.4	9.4	....	....	61.7	593
Side, lean	34.4	0.5	9.1	....	....	55.3	534
Pork organs, fresh:							
Brains, as purchased	75.8	1.6	11.7	....	....	10.3	140
Heart, as purchased	75.6	1.0	17.1	....	....	6.3	125
Kidney, as purchased	77.8	1.2	15.5	....	0.7	4.8	108
Liver, as purchased	71.4	1.4	21.3	....	1.4[1]	4.5	131
Lungs, as purchased	83.3	0.9	11.9	....	....	4.0	84
Pork, pickled, salted or smoked:[2]							
Ham, lean, smoked	53.5	5.5	19.8	....	....	20.8	266
Ham, medium fat, smoked	40.3	4.8	16.3	....	....	38.8	414
Ham, luncheon, cooked	49.2	5.8	22.5	....	....	21.0	279
Shoulder, medium fat, smoked	45.0	6.7	15.9	....	....	32.5	356
Pig's tongue, pickled	58.6	3.6	17.7	....	....	19.8	249
Pig's feet, pickled	68.2	0.9	16.3	....	....	14.8	198
Salt pork, clear fat	7.9	3.9	1.9	....	....	86.2	783
Bacon, smoked	20.2	5.1	10.5	....	....	64.8	625
Ham, deviled	44.1	3.3	19.0	....	....	34.1	383
Sausage:							
Arles	17.2	7.3	26.8	....	....	50.6	563
Bologna	60.0	3.7	18.7	....	0.3[3]	17.6	234
Frankfurt	57.2	3.4	19.6	....	1.1[4]	18.6	250
Pork, as purchased	39.8	2.2	13.0	....	1.1[5]	44.2	454
Pork and beef, as purchased	55.4	1.0	19.4	....	....	24.1	295
Poultry, fresh:							
Chicken, broilers	74.8	1.1	21.5	....	....	2.5	109
Chicken heart, as purchased	72.0	1.4	20.7	....	....	5.5	132
Chicken gizzard, as purchased	72.5	1.4	24.7	....	....	1.4	111
Chicken liver, as purchased	69.3	1.7	22.4	....	2.4[1]	4.2	137
Fowls	63.7	1.0	19.3	....	....	16.3	224
Goose	46.7	0.8	16.3	....	....	36.2	391
Goose liver, as purchased	62.6	1.2	16.6	....	3.7[1]	15.9	224
Turkey	55.5	1.0	21.1	....	....	22.9	291

[1] Largely, or in part, glycogen.
[2] The range of salt content for cured pork products may be taken as 3 to 5 per cent.
[3] Carbohydrate range 0.2 to 3.1 per cent.
[4] Carbohydrate range 0.0 to 6.6 per cent.
[5] Carbohydrate range 0.0 to 8.6 per cent.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Fish and Fish Products.							
Fish, fresh:	%	%	%	%	%	%	
Alewife	74.4	1.5	19.4	....	....	4.9	122
Bass, black	76.7	1.2	20.6	....	....	1.7	98
Bass, red	81.6	1.2	16.9	....	....	0.5	72
Bass, sea	79.3	1.4	19.8	....	....	0.5	84
Bass, striped	77.7	1.2	18.6	....	....	2.8	100
Blackfish	79.1	1.1	18.7	....	....	1.3	87
Bluefish	78.5	1.3	19.4	....	....	1.2	88
Butterfish	70.0	1.2	18.0	....	....	11.0	171
Cod	82.5	0.9	16.7	....	....	0.3	70
Cod, steak	79.7	1.2	18.7	....	....	0.5	79
Eels, salt water	71.6	1.0	18.6	....	....	9.1	156
Flounder	84.2	1.3	14.2	....	....	0.6	62
Haddock	81.7	1.2	17.2	....	....	0.3	72
Halibut	75.4	1.0	18.6	....	....	5.2	121
Herring	72.5	1.5	19.5	....	....	7.1	142
Mackerel	73.4	1.2	18.7	....	....	7.1	139
Perch	77.5	1.2	19.0	....	....	2.4	98
Pickerel	79.8	1.1	18.7	....	....	0.5	79
Porgy	75.0	1.4	18.6	....	....	5.1	120
Salmon	64.6	1.4	22.0	....	....	12.8	203
Shad	70.6	1.3	18.8	....	....	9.5	161
Shad roe	71.2	1.5	20.9	....	2.6	3.8	128
Smelt	79.2	1.7	17.6	....	....	1.8	87
Trout, brook	77.8	1.2	19.2	....	....	2.1	96
Trout, lake	70.8	1.2	17.8	....	....	10.3	164
Whitefish	69.8	1.6	22.9	....	....	6.5	150
Fish, preserved or canned:							
Cod, boneless	55.0	19.0[1]	27.3	....	....	0.3	114
Haddock, smoked	72.5	3.6	23.3	....	....	0.2	95
Halibut, smoked	49.4	15.0[2]	20.7	....	....	15.0	218
Herring, smoked	34.6	13.2[3]	36.9	....	....	15.8	290
Mackerel, salt, dressed	43.4	12.9[4]	17.3	....	....	26.4	307
Mackerel, salt, canned, as purchased	68.2	3.2	19.6	....	....	8.7	157
Mackerel, salt, canned in oil	58.3	4.1	25.4	....	....	14.1	229
Salmon, canned	63.5	2.6	21.8	....	....	12.1	196
Sardines, canned	52.3	5.6	23.0	....	....	19.7	269
Sturgeon, caviare, Russian	38.1	4.6	30.0	....	7.6	19.7	328
Tunney (Tuna), canned in oil	51.3	4.3	23.8	....	0.6	20.0	278
Shellfish, etc., fresh:							
Clams, long	85.8	2.6	8.6	....	2.0[5]	1.0	51
Clams, round	86.2	2.7	6.5	....	4.2[5]	0.4	46
Crabs, hard shell	77.1	3.1	16.6	....	1.2[5]	2.0	89
Crayfish	81.2	1.3	16.0	....	1.0[5]	0.5	73

[1] Largely salt.
[2] One sample contained 12.1 per cent salt.
[3] Salt content 11.7 per cent.
[4] Salt content 10.4 per cent.
[5] Largely, or in part, glycogen.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	*Protein*	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Fish and Fish Products—Concluded.							
Shellfish, etc., fresh—*Concluded:*	%	%	%	%	%	%	
Lobster	79.2	2.2	16.4	....	0.4[1]	1.8	83
Mussels	84.2	1.9	8.7	....	4.1[1]	1.1	61
Oysters	86.9	2.0	6.2	....	3.7[1]	1.2	50
Scallops, as purchased	80.3	1.4	14.8	....	3.4[1]	0.1	74
Terrapin	74.5	1.0	21.2	....	....	3.5	116
Turtle, green	79.8	1.2	19.8	....	....	0.5	84
Shellfish, etc., canned:							
Clams, long, as purchased	85.8	2.2	8.3	....	2.7[1]	0.4	48
Clams, round, as purchased	87.0	2.1	8.9	....	0.9[1]	0.8	46
Crabs, as purchased	80.0	2.0	15.8	....	0.7[1]	1.5	80
Lobster, as purchased	77.8	2.5	18.1	....	0.5[1]	1.1	84
Oysters, as purchased	83.4	1.5	8.8	....	3.9[1]	2.4	72
Shrimp, as purchased	70.8	2.6	25.4	....	0.2	1.0	111
Turtle meat	75.0	0.9	23.4	....	....	0.7	100
Amphibia.							
Frog's legs	83.7	1.0	15.5	....	....	0.2	64
Miscellaneous.							
Gelatin	15.0	1.7	84.2[2]	....	....	0.1	338
Eggs.[3]							
Eggs, fresh (exclusive of shell):							
Duck, whole egg	70.5	1.0	13.3	....	....	14.5	184
white	87.0	0.8	11.1	....	....	trace	44
yolk	45.8	1.2	16.8	....	....	36.2	393
Goose, whole egg	69.5	1.0	13.8	....	....	14.4	185
white	86.3	0.8	11.6	....	....	trace	46
yolk	44.1	1.3	17.3	....	....	36.2	395
Guinea fowl, whole egg	72.8	0.9	13.5	....	....	12.0	162
white	86.6	0.8	11.6	....	....	trace	46
yolk	49.7	1.2	16.7	....	....	31.8	353
Hen, whole egg	73.7	1.0	13.4	....	....	10.5	148
white	86.2	0.6	12.3	....	....	0.2	51
yolk	49.5	1.1	15.7	....	....	33.3	363
Plover, whole egg	74.4	1.0	10.7	....	....	11.7	148
Turkey, whole egg	73.7	0.9	13.4	....	....	11.2	154
white	86.7	0.8	11.5	....	....	trace	46
yolk	48.3	1.2	17.4	....	....	32.9	366
Turtle, fresh water	65.0	2.9	18.1	....	....	11.1	172
sea	76.4	0.4	18.8	....	....	9.8	163
Eggs, cooked:							
Hen, whole, boiled	73.2	0.8	13.2	....	....	12.0	161
white, boiled	86.2	0.6	12.3	....	....	0.2	51
yolk, boiled	49.5	1.1	15.7	....	....	33.3	363
Eggs, dehydrated	4.8	4.0	40.0	....	....	43.7	556

[1] Largely, or in part, glycogen. [2] Nitrogen x 5.55.
[3] *In eggs, as purchased, the shell comprises from 10 to 17 per cent of the weight of the whole egg.*

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Dairy Products, etc.							
lk and Milk Products:	%	%	%	%	%	%	
Milk, whole	87.2	0.7	3.3	....	4.8	4.0	68
condensed (evaporated)	73.4	1.6	6.9	....	9.9	8.2	141
condensed (evaporated), sweetened	26.8	1.7	7.9	....	54.6[1]	9.0	331
skimmed	90.5	0.7	3.4	....	5.1	0.3	37
skimmed, condensed, sweetened	28.7	2.1	9.1	....	59.1[2]	1.0	282
Buttermilk[3]	90.4	0.8	3.6	....	4.1	0.5	35
Kephir	....	....	3.1	....	1.6	2.0	37
Kumiss[4]	89.3	0.4	2.8	....	5.4	2.1	51
Cream, "heavy" (approx. 40 per cent)	54.9	0.5	2.1	....	1.5	41.0	383
Cream, "light" (approx. 20 per cent)	71.9	0.6	2.8	....	2.7	22.0	220
Whey	93.0	0.7	1.0	....	5.0	0.3	27
Milk powder:							
From whole milk	5.9	6.0	25.3	....	37.5	25.3	479
From partly skimmed milk (Mammala type)	4.0	5.8	25.8	....	49.9	14.5	433
From skimmed milk	4.5	8.1	34.6	....	50.9	1.9	359
Malted milk	4.0	3.5	13.8	....	71.9	6.8	404
Cheese:							
American, pale	31.6	3.4	28.8	....	0.3	35.9	440
red	28.6	3.5	29.6	....	....	38.3	463
Camembert	....	....	21.0	....	....	21.7	279
Cheddar	34.3	3.6	26.4	....	3.0	32.7	412
Cheshire	32.6	4.3	32.5	....	4.5	26.1	383
Cottage	72.0	1.8	20.9	....	4.3	1.0	110
Cottage, Jewish[5]	....	....	27.9	....	....	9.2	194
Dutch	35.2	10.0	37.1	....	....	17.7	308
Edam	36.1	4.9	24.1	....	4.6	30.3	388
Full Cream	38.2	4.1	25.4	....	2.0	30.3	382
Limberger	42.1	5.1	23.0	....	0.4	29.4	358
Neufchatel	50.0	2.4	18.7	....	1.5	27.4	327
Pineapple	23.0	5.6	29.9	....	2.6	38.9	480
Roquefort	39.3	6.8	22.6	....	1.8	29.5	363
Skimmed milk	45.7	4.2	31.5	....	2.2	16.4	282
Swiss	31.4	4.8	27.6	....	1.3	34.9	430
Ice Cream, typical	63.3	0.7	3.8	....	19.6	12.6	207

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[1] Cane sugar 40.6 per cent; milk sugar 14.0 per cent.
[2] Cane sugar 40.9 per cent; milk sugar 18.2 per cent.
[3] Contains 0.8 per cent lactic acid.
[4] Contains about 0.8 per cent alcohol.
[5] [illegible]

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories
Fats and Oils.							
Butter, etc.:	%	%	%	%	%	%	
Butter average	12.3	1.6[1]	1.5	....	none	84.6	76[illegible]
Oleomargarine, average	5.4	1.4[2]	0.8	....	none	92.4	83[illegible]
Vegetable oil margarine (nut margarine), average	10.9	2.9[3]	1.4	....	none	84.8	76[illegible]
Salad oils and cooking fats (*olive oil, Wesson oil, Mazola, lard, cottolene, crisco, etc.*), *typical*	*trace*	*trace*	0.2	....	none	99.7	8[illegible]
Soups and Broths.							
Soups, homemade:							
Bean	84.3	1.7	3.2	....	9.4	1.4	[illegible]
Beef	92.9	1.2	4.4	....	1.1	0.4	[illegible]
Chicken	84.3	2.0	10.5	....	2.4	0.8	[illegible]
Clam chowder	88.7	2.0	1.8	....	6.7	0.8	[illegible]
Meat stew	84.5	1.1	4.6	....	5.5	4.3	[illegible]
Soups, broths, etc., canned:							
Asparagus, cream of	87.4	1.4	2.5	....	5.5	3.2	[illegible]
Bouillon, beef	96.6	0.9	2.2	....	0.2	0.1	
clam	95.2	3.1[4]	1.0	....	0.6	0.1	
Celery, cream of	88.6	1.5	2.1	....	5.0	2.8	[illegible]
Chicken gumbo	89.2	1.4	3.8	....	4.7	0.9	[illegible]
soup	93.8	1.0	3.6	....	1.5	0.1	[illegible]
Consomme	95.9	2.2	1.4	....	0.4	0.1	
Corn, cream of	86.8	1.0	2.5	....	7.8	1.9	[illegible]
Julienne	95.9	0.5	2.7	....	0.5	....	
Mock turtle	87.9	2.4	3.0	....	5.7	1.0	
Mulligatawny	89.3	1.2	3.7	....	5.7	0.1	
Oxtail, edible portion	85.4	2.5	3.7	....	7.1	1.3	
Pea soup	86.9	1.2	3.6	....	7.6	0.7	
Pea, cream of green	87.7	1.3	2.6	....	5.7	2.7	
Tomato soup	90.0	1.5	1.8	....	5.6	1.1	
Turtle, green	86.6	1.5	6.1	....	3.9	1.9	
Vegetable	95.7	0.9	2.9	....	0.5	....	
Bouillon cubes:							
as purchased	7.4	73.6[5]	11.4	....	5.8	1.8	
prepared as directed	98.6	1.1	0.2	....	0.1	trace	
Clam extract:							
as purchased	35.8	29.0[6]	23.2	....	11.8	0.2	1[illegible]
prepared as directed	98.6	0.6	0.5	....	0.3	trace	
Yeast extract (Vegex), as purchased	32.5	23.5[7]	31.3	....	12.5[8]	0.2	1[illegible]

[1] Average salt content. Range 0.2 to 4.1 per cent.
[2] Average ash content. Range 0.4 to 3.1 per cent, largely salt.
[3] Average ash content. Range 1.1 to 6.1 per cent, largely salt.
[4] Salt content 2.7 per cent.
[5] Salt content 70.2 per cent.
[6] Salt content 20.8 per cent.
[7] Salt content about 13 per cent.
[8] Undetermined nitrogen-free extract.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Cereal Products, etc.							
Alimentary Pastes:	%	%	%	%	%	%	
Macaroni (average)	10.3	1.3	13.4	....	74.1[1]	0.9	358
Macaroni, cooked	78.4	1.3	3.0	....	15.8[1]	1.5	89
Noodles	*10.7*	*1.0*	*11.7*	*0.4*	*75.2*	*1.0*	*357*
Spaghetti	10.6	0.6	12.1	0.4	75.9	0.4	356
Vermicelli	11.0	4.1	10.9	....	72.0[1]	2.0	350
Bread, soft:							
Bread, alfalfa	20.5	2.7	10.6	0.9	64.0	1.3	310
brown	43.6	2.1	5.4	....	47.1[1]	1.8	226
corn (johnny cake)	38.9	2.2	7.9	....	46.3[1]	4.7	259
Graham	35.7	1.5	8.9	1.1	51.0	1.8	256
peanut	24.6	3.8	33.6	5.5	19.7	12.8	328
rye	35.7	1.5	9.0	0.5	52.7	0.6	252
rye, Jewish	35.0	2.2	9.1	0.6	52.0	1.1	254
rye, whole	50.7	0.9	11.9	1.2	34.7	0.6	192
rye and wheat	35.3	1.0	11.9	....	51.5[1]	0.3	256
wheat (average)	35.3	1.1	9.2	0.5	52.6	1.3	259
wheat, whole	38.4	1.3	9.7	1.2	48.5	0.9	241
Buns, hot cross	36.7	0.9	7.9	....	49.7[1]	4.8	274
Biscuit, homemade	32.9	0.5	8.7	0.7	54.6	2.6	277
Maryland	24.6	1.3	8.4	1.3	58.8	5.6	309
soda	22.9	1.5	9.3	....	52.6[1]	13.7	371
Rolls, all analyses	29.2	1.1	8.9	0.6	56.1	4.1	297
Bread, hard, and crackers:							
Bread, toasted	24.0	1.7	11.5	....	61.2[1]	1.6	305
Zwieback	5.8	1.0	9.8	....	73.5[1]	9.9	422
Crackers, Boston	7.5	1.9	11.0	0.8	70.3	8.5	402
butter	7.2	1.5	9.6	0.4	71.2	10.1	414
cream	6.8	1.7	9.7	0.6	69.1	12.1	424
egg	5.8	1.0	12.6	0.4	66.2	14.0	441
flatbread	9.8	1.2	14.9	....	73.6[1]	0.5	359
Graham	5.4	1.4	10.0	1.5	72.3	9.4	414
oatmeal	6.3	1.8	11.8	1.9	67.1	11.1	416
oyster	4.8	2.9	11.3	0.2	70.3	10.5	421
pilot	8.7	1.0	11.1	0.3	73.9	5.0	385
pretzels	9.6	4.0	9.7	0.5	72.3	3.9	363
saltines	5.6	2.6	10.6	0.5	68.0	12.7	429
soda	5.9	2.1	9.8	0.3	72.8	9.1	412
water	6.4	1.2	11.7	0.4	75.3	5.0	393
Pastry, etc.:							
Cake, coffee	21.3	0.9	7.1	0.4	62.8	7.5	347
cup	15.6	1.0	5.9	0.3	68.2	9.0	377
frosted	18.2	2.1	5.9	....	64.8[1]	9.0	364
gingerbread	18.8	2.9	5.8	0.9	62.6	9.0	354
sponge	15.3	1.8	6.3	....	65.9[1]	10.7	385

[1] Includes fiber.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Cereal Products, etc.—Continued.							
Pastry, etc.—*Concluded:*	%	%	%	%	%	%	
Cookies	8.1	1.5	7.0	0.5	73.2	9.7	408
Doughnuts	18.3	0.9	6.7	0.7	52.4	21.0	425
Fig bars	17.9	1.1	4.6	1.7	68.1	6.6	350
Ginger snaps	6.3	2.6	6.5	0.7	75.3	8.6	405
Lady fingers	15.0	0.6	8.8	0.2	70.4	5.0	362
Macaroons	12.3	0.8	6.5	1.1	64.1	15.2	419
Pie, apple	42.5	1.8	3.1	....	42.8[1]	9.8	272
cream	32.0	1.0	4.4	....	51.2[1]	11.4	325
custard	62.4	1.0	4.2	....	26.1[1]	6.3	178
lemon	47.4	1.5	3.6	....	37.4[1]	10.1	255
mince	41.3	2.5	5.8	....	38.1[1]	12.3	286
raisin	37.0	1.5	3.0	....	47.2[1]	11.3	303
squash	64.2	1.3	4.4	....	21.7[1]	8.4	180
Pudding, Indian meal	60.7	1.5	5.5	....	27.5[1]	4.8	175
rice	59.4	0.6	4.0	....	31.4[1]	4.6	183
tapioca	64.5	0.8	3.3	....	28.2[1]	3.2	155
Wafers, miscellaneous	6.6	1.6	8.7	0.4	74.1	8.6	409
vanilla	6.7	1.1	6.6	0.3	71.3	14.0	438
Breakfast foods:							
Barley preparations:							
Cream of Barley	9.2	1.4	11.1	0.6	76.1	1.6	363
Farwell & Rhines' Barley Crystals	9.9	1.2	11.5	0.9	75.2	1.3	359
Quaker Scotch Brand Pearled Barley	12.1	1.0	9.5	0.3	76.2	0.9	351
Corn (maize) preparations:							
Cerealine	11.2	1.5	6.9	0.1	79.9	0.4	351
E-C Corn Flakes, Toasted	12.1	2.2	6.6	0.2	78.6	0.3	344
F. S. Granulated Hominy	13.3	0.4	8.0	0.2	77.1	1.0	349
Hecker's Cream Hominy	11.7	0.3	9.8	0.5	77.3	0.4	352
H-O New Process Hominy	11.3	0.4	8.0	0.2	79.8	0.3	354
Jackson's Roman Meal	8.5	3.7	13.3	5.0	66.1	3.4	348
Jersey Corn Flakes	7.7	0.9	8.5	0.3	82.3	0.3	366
Kellogg's Toasted Corn Flakes	11.7	2.7	6.4	0.2	78.8	0.2	343
Korn Kinks	12.0	2.2	7.4	0.1	77.9	0.4	345
Nichols' Snow White Samp	13.4	0.3	7.8	0.5	77.7	0.3	345
Post Tosties	11.7	1.8	6.6	0.2	79.4	0.3	347
Quaker Best Yellow Corn Meal	12.3	0.5	7.5	0.2	78.7	0.8	352
Quaker Corn Puffs	12.0	0.4	8.7	0.1	78.5	0.3	352
Quaker Toasted Corn Flakes	11.6	1.3	6.8	0.0	79.9	0.4	350
Ralston Hominy Grits	11.3	1.0	9.0	0.4	75.4	2.9	364
Street's Perfection Hominy	12.4	0.4	7.9	0.1	77.9	1.3	355
Sunbeam Pearl Hominy	14.3	0.4	9.4	0.3	75.0	0.6	343
Sunseal Sunny Corn	12.3	0.4	8.3	0.4	78.2	0.4	350
Sunseal Cream Corn Meal	12.0	0.5	8.9	0.4	77.2	1.0	353

[1] Includes fiber.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Cereal Products, etc.—Continued.							
Breakfast foods—*Continued:*							
Corn (maize) preparations—*Concl.*	%	%	%	%	%	%	
Sunseal Hominy Grits	11.6	0.5	8.5	0.4	77.8	1.2	356
Washington Corn Crisps	12.1	2.9	7.8	0.2	76.8	0.2	340
Quaker Hominy Grits	13.2	0.5	7.9	0.2	77.7	0.5	347
Oat preparations:							
Bestovotes	11.0	2.1	16.2	1.0	63.1	6.6	377
Bufceco Rolled Oats	11.1	2.0	15.1	1.0	64.0	6.8	378
Fruited Oats	9.7	3.3	13.1	1.3	68.2	4.9	369
Grandmother's Crushed Oats..	10.7	1.9	14.9	0.6	65.4	6.5	380
Health Brand White Oats	10.9	2.0	13.8	1.0	64.5	7.8	383
Hecker's Cream Oat Meal ...	11.5	1.8	15.6	0.9	64.6	5.6	371
Hornby's Steam Cooked Oat Meal	10.6	1.7	16.1	0.8	64.1	6.7	381
Keen & Robinson's Granulated Scotch Oatmeal	10.4	1.9	13.7	0.8	64.1	9.1	393
Leggett's Premier 15 Minute Oat Flakes	11.3	1.8	17.2	0.6	63.7	5.4	372
McCann's Irish Oat Meal	9.2	1.8	15.1	0.3	64.9	8.7	398
Mother's Crushed Oats	10.9	1.6	15.6	0.9	64.9	6.1	377
Paw-Nee Rolled Oats	10.8	1.9	15.8	0.8	64.0	6.7	380
Purity Rolled Oats	13.5	2.0	16.3	1.0	61.1	6.1	365
Quaker Oats	10.8	1.9	15.9	0.9	64.5	6.0	376
Robinson's Patent Groats	8.4	1.8	12.8	0.7	67.7	8.6	399
Scotch Porage Oats	10.1	1.7	13.3	0.4	64.9	9.6	399
Sovereign 15 Minute Oat Flakes	10.8	2.0	16.5	0.9	64.0	5.8	374
White Rose Rolled Oats	10.3	1.9	14.3	0.7	64.8	8.0	388
Rice preparations:							
Comet Cereal	11.3	0.3	7.2	0.2	80.7	0.3	354
Cook's Flaked Rice	12.6	0.4	7.8	0.2	78.9	0.1	348
Cook's Malto Rice	11.3	0.6	7.6	0.1	80.2	0.2	353
Kellogg's Toasted Rice Biscuit	5.0	3.7	10.1	0.2	80.7	0.3	366
Kellogg's Toasted Rice Flakes	4.7	3.4	10.0	0.2	81.3	0.4	369
Milk Rice	12.3	3.2	6.9	0.2	77.2	0.2	338
Quaker Puffed Rice	12.2	0.4	7.6	0.1	79.5	0.2	350
Rye preparations:							
Cream of Rye	11.5	1.7	12.0	1.4	71.8	1.6	350
Kellogg's Toasted Rye Flakes	8.1	2.2	11.4	0.6	76.2	1.5	364
Ry-Krisp	5.8	2.8	14.0	1.3	74.4	1.7	369
Wheat preparations:							
Alber's Wheat Flakes Mush..	11.5	1.6	11.1	0.3	73.4	2.1	357
Cero-Vita	4.6	3.5	8.9	0.3	82.0	0.7	370
Cinnamon Rusks	9.9	0.7	10.3	0.2	71.7	7.2	393
Cream of Wheat	13.1	0.6	11.5	0.2	73.7	0.9	340
Cresco Grits	11.1	0.6	17.8	0.5	68.6	1.4	358

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Cereal Products, etc.—Continued.							
Breakfast foods—*Continued:*							
Wheat preparations—*Concluded:*	%	%	%	%	%	%	
Crystal Wheat	9.5	1.9	11.3	1.7	73.6	2.0	358
Dieto Rusks	6.4	1.5	15.9	1.0	66.1	9.1	410
Force	10.7	2.8	10.6	1.1	73.7	1.1	347
F S. Farina (Quaker Farina)	13.7	0.4	10.2	0.2	74.6	0.9	347
Fruited Wheat	9.9	3.6	15.6	2.4	66.2	2.3	348
Grandmother's A. & P. Farina	12.9	0.6	10.8	0.1	75.0	0.6	349
Granola	6.1	2.3	13.9	0.6	76.3	0.8	368
Granose Biscuit	11.3	3.9	10.3	1.8	71.1	1.6	340
Granose Flakes	6.0	3.9	10.3	0.5	75.4	3.9	378
Grape Nuts	10.3	1.9	11.5	1.5	74.2	0.6	348
Hecker's Farina	12.7	0.6	10.0	0.1	75.9	0.7	350
Holland Rusk	11.0	1.3	12.1	0.1	70.4	5.1	376
Jireh Frumenty	6.2	1.4	12.3	1.1	77.3	1.7	374
Jireh Whole Wheat Farina	6.2	1.8	12.9	2.2	74.6	2.3	371
Kellogg's Breakfast Toast	*7.7*	*1.6*	*13.6*	*0.3*	*74.9*	*1.9*	*371*
Kellogg's Krumbles	10.0	2.6	12.0	1.9	72.3	1.2	348
Kellogg's Toasted Wheat Biscuit	5.8	2.4	14.2	1.5	74.7	1.4	368
Kellogg's Toasted Wheat Flakes	5.2	2.7	9.3	1.2	80.5	1.1	369
Kellogg's Zwieback	6.2	1.6	14.3	0.2	76.1	1.6	376
Leggett's Premier Farina	14.1	0.5	11.1	0.1	73.3	0.9	346
Malt Breakfast Food	9.6	1.4	13.8	1.0	72.7	1.5	360
Manana Gluten Breakfast Food	7.6	2.5	42.6	1.7	43.6	2.0	363
Mapl-Flake	10.8	2.8	9.3	1.2	74.7	1.2	347
Mother's Wheat Hearts	13.5	0.4	10.7	0.2	74.1	1.1	349
Pettijohn's Breakfast Food	10.3	1.7	9.1	2.0	74.9	2.0	354
Pillsbury' Best Cereal	11.3	0.5	11.5	0.1	75.9	0.7	356
Quaker Cracked Wheat	11.7	1.7	9.3	1.7	73.3	2.3	351
Quaker Puffed Wheat	11.5	1.8	13.1	1.6	70.2	1.8	349
Quaker Wheat Berries	9.8	1.4	14.0	1.2	71.6	2.0	360
Ralston Health Food	12.4	1.4	11.9	1.1	71.5	1.7	349
Ralston Wheat Food	11.9	1.1	11.3	0.8	73.1	1.8	354
Sanitas Granuto	4.9	1.3	10.1	0.4	81.6	1.7	382
Saxon Wheat Food	9.8	0.8	12.8	0.5	74.4	1.7	364
Shredded Wheat Biscuit	8.5	1.5	11.0	2.6	75.0	1.4	357
Street's Perfection Farina	13.1	0.5	10.3	0.1	74.9	1.1	351
Triscuit	10.3	1.7	11.0	1.7	73.9	1.4	352
Vitos	11.6	0.5	11.1	0.2	75.6	1.0	356
Wheatena	10.4	0.7	11.3	0.6	74.2	2.8	367
Wheatlet	12.2	0.8	12.8	0.3	72.3	1.6	355
Whole Grain Wheat (prepared)	66.2	1.5	6.6	1.2	23.7	0.8	128
Zest	10.7	2.6	9.0	1.2	75.3	1.2	348
Wheat bran:							
Ballard's Obelisk Sanitary Edible Bran	11.5	4.5	17.3	5.6	55.7	5.4	301
Culp's Capitol Health Bran	11.2	5.3	13.4	8.2	57.6	4.3	323

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Cereal Products, etc.—Continued.							
Breakfast Foods—*Concluded:*							
Wheat Bran—*Concluded:*	%	%	%	%	%	%	
Health Food Co.'s Wheat Bran	11.6	5.6	14.3	8.2	56.2	4.1	319
Jireh Wheat Bran	11.1	4.3	16.8	6.3	56.7	4.8	337
Johnson's Educator Wheat Bran	11.6	6.1	15.4	7.8	54.4	4.7	322
Kellogg's Sterilized Wheat Bran	*9.6*	*6.0*	*16.3*	8.5	54.4	5.2	330
Wheat bran biscuit and other laxative preparations:							
Bran Biskue	8.5	3.1	12.1	2.2	61.0	13.1	410
Bran-eata Biscuit	9.8	4.4	9.1	3.6	72.2	0.9	333
Bran Zos	11.9	3.0	13.2	3.8	65.6	2.5	338
Brose Good Health Breakfast Food	10.1	2.6	14.4	3.1	65.5	4.3	358
Cerag	9.2	3.6	11.3	2.0	73.0	0.9	345
Cerena	7.2	4.9	27.8	2.4	46.3	11.4	399
Christian's Laxative Bread	9.9	2.8	10.0	1.3	74.6	1.4	351
Christian's Laxative Cereal Flakes	13.0	1.7	10.4	1.0	72.5	1.4	344
Colax	13.1	2.1	1.1	0.1	82.8	0.8	343
Dietetic Bran Biscuit	9.3	5.0	9.9	1.7	69.1	5.0	361
Educator Bran Cookies	7.1	3.3	8.9	1.5	64.7	14.5	425
Educator Bran Meal	11.8	2.9	12.3	3.8	66.4	2.8	340
F. B. A. Laxative Health Biscuit	11.1	3.1	6.1	0.7	77.3	1.7	349
Fruit Nut Cereal	7.3	3.2	13.5	2.4	72.4	1.2	354
Good Health Biscuit (Kellogg)	10.9	4.2	7.7	1.5	74.5	1.2	340
Health Food Wafers	9.7	5.3	10.0	1.4	65.7	7.9	374
India (Digestive) Biscuit	8.7	5.0	12.8	5.2	66.1	2.2	335
Laxa	6.6	5.0	12.4	6.6	66.6	2.8	341
Laxative Biscuit (Kellogg)	9.4	3.0	16.7	2.4	57.7	10.8	395
Mansfield's Agar Agar Wafers	7.9	2.3	7.1	0.8	69.9	12.0	416
Oval Digestive Biscuit (H.&P.)	8.8	2.1	7.8	0.5	64.5	16.3	436
Uncle Sam Health Food	6.3	3.1	21.3	4.0	40.9	24.4	468
Zim	13.2	2.0	7.4	1.5	74.2	1.7	342
Miscellaneous preparations:							
Dieto Nut Cereal	5.0	2.0	21.6	1.2	51.8	18.4	459
Dieto Wheat and Barley Cereal	6.8	1.7	11.6	2.0	75.7	2.2	369
Jireh Wheat Nuts	7.6	2.3	19.0	1.0	54.5	15.6	434
Malabar Manoca	13.3	1.3	0.6	0.6	84.1	0.1	340
Post Tavern Porridge	12.7	1.5	10.3	0.2	74.5	0.8	346
Post Tavern Special	9.9	0.9	10.9	0.3	76.9	1.1	361
Sea Moss Farina	15.6	13.6	9.1	1.5	59.9	0.3	279
Sunbeam Tapioca	13.5	0.2	0.6	0.1	85.5	0.1	345
Trix	6.2	1.5	14.5	0.3	77.3	0.2	369
Trufood (Trufood Co.)	5.7	1.4	11.5	1.8	77.1	2.5	377
Zep (Battle Creek Food Co.)	5.0	2.9	14.0	1.3	74.6	2.2	374

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Cereal Products, etc.—Concluded.							
Flours, meals, etc:	%	%	%	%	%	%	
Barley flour	11.4	1.6	12.3	1.0	71.3	2.4	356
Buckwheat flour	13.6	0.9	6.4	0.4	77.5	1.2	346
Corn flour	12.3	0.9	8.4	0.4	76.2	1.8	355
Corn meal	12.5	1.0	9.2	1.0	74.4	1.9	362
Oat flour	10.3	1.8	15.1	0.7	65.7	6.4	381
Potato flour	16.0	0.4	0.5	....	83.0[1]	0.1	335
Rice flour	11.9	0.8	7.3	0.1	79.3	0.6	352
Rye flour	12.9	0.7	6.8	0.4	78.3	0.9	349
Rye meal	11.4	1.5	13.6	1.8	69.7	2.0	351
Soy bean flour	5.1	4.5	42.5	3.7	24.3	19.9	446
Soy bean meal	10.1	5.5	38.3	4.6	26.6[3]	14.9	394
Wheat flour, entire	11.4	1.0	13.8	0.9	71.0	1.9	356
Wheat flour, Graham	11.3	1.8	13.3	1.9	69.5	2.2	351
Wheat flour, patent, average	12.0	0.5	11.4	0.3	74.8	1.0	354
Vegetables.							
Vegetables, fresh (unless otherwise stated):							
Aralia Cordata (Udo)	95.2	0.5	1.0	0.5	2.6[3]	0.2	16
Artichokes	79.5	1.0	2.6	0.8	15.9[4]	0.2	76
Jerusalem, fresh, whole	77.8	2.0	2.9	0.8	16.4[4]	0.1	78
cooked, edible portion	78.8	1.4	2.4	0.8	16.5[4]	0.1	77
Asparagus	93.6	0.7	2.1	0.7	2.7	0.2	21
Basella	....	....	2.5	....	1.7	0.5	21
Beans, butter	58.9	2.0	9.4	....	29.1[1]	0.6	159
cranberry, young pods	....	....	0.4	....	0.6	none	4
medium	....	....	1.3	....	1.7	0.6	17
fancy	....	....	1.0	....	2.1	0.1	13
Lima	68.5	1.7	7.1	1.7	20.3	0.7	116
refugee, young pods	....	....	0.5	....	0.8	none	5
medium	....	....	1.3	....	3.0	0.1	18
fancy	....	....	1.1	....	1.4	0.1	11
string	89.2	0.8	2.3	1.9	5.5[5]	0.3	34
string, cooked	95.3	0.9	0.8	....	1.0[1]	1.1	21
Beets	87.5	1.1	1.6	0.9	8.8[6]	0.1	43
cooked	88.6	1.6	2.3	....	7.4[1]	0.1	40
Borage (salad plant)	....	....	3.0	....	0.4	0.4	17
Brussels sprouts	....	....	1.5	....	3.4	0.1	21
Burdock	....	....	4.5	....	7.4	0.1	49
Cabbage	91.5	1.0	1.6	1.1	4.5[7]	0.3	27
Carrots	88.2	1.0	1.1	1.1	8.2	0.4	41
Cassava, *root*	....	....	1.6	....	27.1	0.2	117

[1] Includes fiber.
[2] Includes 1.1 per cent starch and sugar.
[3] About ¼ available.
[4] Chiefly inulin.
[5] Carbohydrate range 3.9 to 10 per cent.
[6] Carbohydrate range 6.0 to 10 per cent.
[7] Carbohydrate range 3.0 to 6.5 per cent.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Vegetables—Continued.							
Vegetables, fresh—*Continued.*	%	%	%	%	%	%	
Cauliflower	92.3	1.0	1.8	1.0	3.7	0.5	27
Celeriac	....	....	1.8	....	6.0	0.2	33
Celery	94.5	1.0	1.1	....	3.3[1]	0.1	19
Celery root	....	....	2.0	....	6.3	0.4	37
Chard	89.6	1.6	3.2	....	5.0[1]	0.6	38
Chayote (tayote)	*91.9*	*0.4*	*0.9*	*0.8*	*5.9*	*0.1*	*28*
Chenopodium	....	....	8.5	....	2.7	1.1	55
Chicory, root	....	....	....	....	15.0	....	....
leaves, Italian	....	....	1.9	....	0.8	0.4	14
Chinese vegetables:							
Kai Tsoi	94.5	1.1	1.7	0.7	1.8	0.2	16
Bak Toy	95.9	1.1	1.2	0.6	1.1	0.1	10
Collards	87.1	1.5	4.5	....	6.3[1]	0.6	49
Corn, green	75.4	0.7	3.1	0.5	19.2	1.1	99
Cucumbers	95.4	0.5	0.8	0.7	2.4	0.2	14
Egg plant	92.9	0.5	1.2	0.8	4.3	0.3	25
Endive	....	....	1.0	....	2.6	none	14
Finnochio	....	....	1.5	....	1.6	0.1	13
Greens, beet, cooked	89.5	1.7	2.2	....	3.2[1]	3.4	52
dandelion	81.4	4.6	2.4	....	10.6[1]	1.0	61
turnip salad	86.7	2.2	4.2	....	6.3[1]	0.6	47
Kale	....	....	3.0	....	2.1	0.4	24
Kale, sea	....	....	1.4	....	3.8	none	21
Kohl-rabi	91.1	1.3	2.0	1.3	4.2	0.1	26
Lamb's quarters	....	....	3.8	....	1.7	0.6	27
Leeks	....	....	2.9	....	4.0[2]	0.1	29
Lettuce	94.7	0.9	1.2	0.7	2.2	0.3	16
Mushrooms	88.1	1.2	3.5[2]	0.8	6.0[3]	0.4	42
Mustard	....	....	2.4	....	0.3[3]	0.3	14
Okra	90.2	0.6	1.6	3.4	4.0	0.2	24
Onions	87.6	0.6	1.6	0.8	9.1	0.3	46
cooked	91.2	0.9	1.2	....	4.9[1]	1.8	41
Orach	....	....	4.6	....	0.2[2]	0.4	23
Oyster plant	....	....	1.2	....	7.0	0.1	34
Palmetto cabbage	87.4	1.7	3.3	0.9	6.1	0.6	43
cooked	88.9	1.2	2.9	0.9	5.6	0.5	39
Parsnips	83.0	1.4	1.6	2.5	11.0[4]	0.5	55
Peas, green	74.6	1.0	7.0	1.7	15.2	0.5	93
cooked	73.8	1.5	6.7	....	14.6[1]	3.4	116
Peppers, Neapolitan	....	....	1.1	....	5.7	0.3	30
sweet, green	....	....	0.8	....	4.1	0.1	21
Potatoes	78.3	1.0	2.2	0.4	18.0	0.1	82
air (tropical Asia)	....	....	1.9	....	16.3	0.4	76
boiled	75.5	1.0	2.5	0.6	20.3	0.1	92

Includes fiber.
Largely unassimilable.
Largely salt.

[2] Starch and sugar.
[4] Carbohydrate range 6 to 14 per cent.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Vegetables—Continued.							
Vegetables, fresh—*Concluded.*	%	%	%	%	%	%	
Potatoes, cooked, chips	2.2	4.5	6.8	....	46.7[1]	39.8	572
cooked, mashed and creamed	75.1	1.5	2.6	....	17.8[1]	3.0	109
sweet	69.0	1.1	1.8	1.3	26.1	0.7	118
cooked	51.9	0.9	3.0	....	42.1[1]	2.1	199
Pumpkins	93.1	0.6	1.0	1.2	4.0	0.1	21
Radishes	91.8	1.0	1.3	0.7	5.1	0.1	27
Rhubarb	94.4	0.7	0.6	1.1	2.5	0.7	19
Roquette (rocket salad)	....	....	0.7	....	0.3[3]	0.4	8
Rutabagas	88.9	1.1	1.3	1.2	7.3	0.2	36
Sauerkraut	88.8	5.2[2]	1.7	....	3.8[1]	0.5	27
Sorrel	....	....	2.1	....	0.1[3]	0.2	11
Spinach	92.3	2.1	2.1	0.9	2.3	0.3	20
cooked	89.8	1.4	2.1	....	2.6[1]	4.1	56
Squash	88.3	0.8	1.4	0.8	8.2	0.5	43
Tomatoes, green	94.8	0.6	1.2	0.4	2.8	0.2	18
ripe	94.3	0.5	0.9	0.6	3.3	0.4	20
Truffles	....	....	9.1	....	7.0	0.5	69
Turnips	89.6	0.8	1.3	1.3	6.8	0.2	34
Vegetable marrow	93.1	1.1	0.5	1.2	4.0[4]	0.1	19
cooked	93.0	1.0	0.4	1.4	4.1[5]	0.1	19
Watercress	....	....	0.7	....	3.7	0.5	22
Yams	....	....	1.6	....	23.6	0.2	103
Yautia (Janier)	....	....	4.2	....	53.0	0.4	232
Vegetables, dried:							
Beans	12.6	3.5	22.5	4.4	55.2	1.8	327
carob	4.0	2.7	6.3	5.7	80.7	0.6	353
frijoles (New Mexico)	7.5	4.2	21.9	....	65.1[1]	1.3	360
Lima	10.4	4.1	18.1	....	65.9[1]	1.5	350
mesquite	4.8	3.4	12.2	....	77.1[1]	2.5	380
soy	10.1	5.5	38.3	4.6	26.6	14.9	394
Carrots, evaporated	3.5	4.9	7.7	....	80.3[1]	3.6	384
Lentils	8.4	5.7	25.7	....	59.2[1]	1.0	349
Peas	9.5	2.9	24.6	4.5	57.5	1.0	337
cow	13.0	3.4	21.4	4.1	56.7	1.4	325
Peppers, green	....	....	15.5	....	63.0[1]	8.5	391
red	....	....	9.4	....	70.0[1]	7.7	387
Potatoes, evaporated	7.1	3.1	8.5	....	80.9[1]	0.4	361
Tomatoes	7.3	9.4	12.9	....	62.3[1]	8.1	374
Vegetables, canned:							
Artichokes	92.5	1.7	0.8	0.6	4.4	....	21
Asparagus	94.4	1.2	1.5	0.5	2.3	0.1	16

[1] Includes fiber.
[2] Largely salt.
[3] Starch and sugar.
[4] 1.8 per cent starch and sugar.
[5] 2.0 per cent starch and sugar.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories
Vegetables—Concluded.							
Vegetables, canned—*Concluded:*							
Beans, baked	68.9	2.1	6.9	2.5	17.1	2.5	11[illegible]
haricots vers	95.2	1.1	1.1	0.5	2.0	0.1	1[illegible]
flageolets	81.6	1.2	4.6	1.0	11.5	0.1	6[illegible]
Lima	79.5	1.6	4.0	1.2	13.4	3.0	7[illegible]
little green	93.8	1.5	1.2	0.6	2.8	0.1	1[illegible]
red kidney	*72.7*	*1.6*	*7.0*	*1.2*	*17.3*	*0.2*	9[illegible]
string	93.7	1.3	1.1	0.5	3.3	0.1	1[illegible]
wax	*94.6*	*1.2*	*1.0*	*0.6*	*2.5*	*0.1*	1[illegible]
Brussels sprouts	93.7	1.3	1.5	0.5	2.9	0.1	1[illegible]
Corn, green	76.1	0.9[1]	2.8	0.8	18.2	1.2	9[illegible]
Corn and tomatoes	87.6	0.8	1.6	0.5	9.1	0.4	4[illegible]
Macedoine (mixed vegetables)	93.1	1.0	1.4	0.6	3.9	....	21
Okra	94.4	1.2[2]	0.7	0.7	2.9	0.1	15
Peas, green	85.3	1.1[3]	3.6	1.2	8.6	0.2	51
Potatoes, sweet	55.2	1.1	1.9	0.8	40.6	0.4	174
Pumpkins	91.6	0.7	0.8	1.1	5.6	0.2	27
Squash	87.6	0.5	0.9	0.7	9.8	0.5	47
Succotash	75.9	0.9	3.6	0.9	17.7	1.0	94
Tomatoes	94.0	0.6	1.2	0.5	3.5	0.2	21
Pickles, Condiments, etc.							
Pickles, condiments, etc.:							
Capers	....	....	3.2	....	5.0	0.5	37
Catsup, tomato	....	....	1.8	....	10.0[4]	0.2	49
Chili sauce	....	....	....	....	20.0[5]	....	....
Horseradish	86.4	1.5	1.4	....	10.5[6]	0.2	49
Olives, green	*76.4*	*6.6*[7]	1.3	*1.1*	2 5	*21.1*	*124*
ripe	75.0	2.7[8]	1.4	0.9	2.0	18.0	176
Mustard, prepared	....	....	4.7	....	5.0	4.1	76
prepared, with cereal added	....	....	3.5	....	7.0	1.9	59
Pickles, cucumber	92.9	3.6	0.5	....	2.7[6]	0.3	16
mixed	93.8	0.7	1.1	....	4.0[6]	0.4	24
spiced	....	....	0.4	....	21.0	0.1	87
Vinegar, cider	....	....	none	....	0.3[9]	none	1
distilled	....	....	*none*	....	*none*	*none*	....
malt	....	....	none	....	0.5[10]	....	....
spiced salad	....	....	....	....	10.0	....	....
Tarragon	....	....	....	....	0.2[10]	....	....
wine	....	....	....	....	0.4	....	....

[1] Includes about 0.4 per cent salt.
[2] *Includes about 0.7 per cent salt.*
[3] Includes about 1.1 per cent salt.
[4] Carbohydrate range 3 to 26 per cent.
[5] Carbohydrate range 14 to 28 per cent.
[6] Includes fiber.
[7] Includes 5.9 per cent salt.
[8] Includes 2.1 per cent salt.
[9] Carbohydrate range 0.3 to 1.5 per cent.
[10] Manufacturers' analysis.

TABLE I. ANALYSES OF COMMON FOODS—*Continued*.

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Fruits, Berries, etc.							
Fruits, berries, etc., fresh:	%	%	%	%	%	%	
Apples	84.6	0.3	0.4	1.2	13.0	0.5	58
Apricots	85.0	0.5	1.0	....	13.4[1]	....	58
Avocados (alligator pears)	77.3	0.8	1.1	....	7.1[1]	13.7	156
Bananas	75.3	0.8	1.3	1.0	21.0	0.6	95
Blackberries	86.3	0.5	1.3	2.5	8.4	1.0	48
Cherries	80.9	0.6	1.0	0.2	16.5	0.8	77
Citrang juice	....	....	1.3	....	6.9	....	33
Cranberries	88.9	0.2	0.4	1.5	8.4	0.6	41
Currants	85.0	0.7	1.4	....	12.8[1]	....	....
Egg fruit	51.3	1.1	3.4	1.3	41.0	1.9	195
Figs	79.1	0.6	1.5	....	18.8[1]	....	....
Gooseberries	....	....	0.4	....	12.0	....	....
Grapes	77.4	0.5	1.3	4.3	14.9	1.6	79
Grape juice	....	....	....	....	15.0[2]	....	....
Grape fruit	89.7	0.5	0.8	0.4	8.6[3]	trace	36
Huckleberries	81.9	0.3	0.6	....	16.6[1]	0.6	74
Lemons	89.3	0.5	1.0	1.1	7.4	0.7	40
Lemon juice	....	....	....	....	9.8[1]	....	....
Loganberries	....	....	4.6	....	7.2[4]	0.6	53
Loganberry juice	....	....	0.6	....	6.8[4]	....	....
Loquat	74.9	1.2	0.3	0.7	23.0	....	....
Mangoes	....	....	....	....	13.0	....	....
Mulberries	....	....	0.3	....	12.0	....	....
Muskmelons	89.5	0.6	0.6	2.1	7.2	0.3	34
Nectarines	82.9	0.6	0.6	....	15.9[1]	....	....
Oranges	86.9	0.5	0.8	....	11.6[1]	0.2	51
Papaya (papaw)	90.8	0.9	0.8	1.1	6.3	0.1	29
Peaches	89.4	0.4	0.7	3.6	5.8	0.1	27
Pears	84.4	0.4	0.6	2.7	11.4	0.5	53
Persimmons	66.1	0.9	0.8	1.8	29.7	0.7	128
Pineapple	89.3	0.3	0.4	0.4	9.3	0.3	42
Plums	78.4	0.5	1.0	....	20.1[1]	....	....
Pomegranates	76.8	0.6	1.5	2.7	16.8	1.6	88
Prunes	79.6	0.6	0.9	....	18.9[1]	....	....
Quince	84.2	0.4	0.3	1.8	13.2	0.1	55
Raspberries, black	84.1	0.6	1.7	....	12.6[1]	1.0	66
red	85.8	0.6	1.0	2.9	9.7	....	....
Sapodilla	77.0	0.5	0.6	1.1	19.4	1.4	93
Sour sop	80.8	1.1	0.8	....	17.2	0.1	73
Strawberries	90.4	0.6	1.0	1.4	6.0	0.6	33
Tangello juice	....	....	0.7	....	0.9	....	....
Watermelons	92.4	0.3	0.4	....	6.7[1]	0.2	30
Whortleberries	....	....	0.7	....	10.0	0.3	46

[1] Includes fiber.
[2] Carbohydrate range 11 to 20 per cent.
[3] Includes 7.6 per cent sugar.
[4] Invert sugar.

TABLE I. ANALYSES OF COMMON FOODS—*Continued.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Fruits, Berries, etc.—Concluded.							
Fruits, berries, etc., dried:	%	%	%	%	%	%	
Apples	28.1	2.0	1.6	....	66.1[1]	2.2	291
Apricots	29.4	2.4	4.7	....	62.5[1]	1.0	278
Citron	19.0	0.9	1.5	....	78.1[1]	1.5	332
Currants	17.2	4.5	2.4	....	74.2[1]	1.7	322
Dates	15.4	1.3	2.1	....	78.4[1]	2.8	347
Figs	18.8	2.4	4.3	....	74.2[1]	0.3	317
Prunes	22.3	2.3	2.1	....	73.3[1]	....	....
Raisins	14.6	3.4	2.6	....	76.1[1]	3.3	345
Raspberries	8.1	2.6	7.3	....	80.2[1]	1.8	366
Fruits, berries, etc., canned:							
Apples, crab	42.4	0.5	0.3	....	54.4[1]	2.4	240
Apple sauce	61.6	0.7	0.2	....	37.2[1]	0.8	157
Apricots	81.4	0.4	0.9	....	17.3[1]	....	....
Apricot sauce	45.2	2.8	1.9	....	48.8[1]	1.3	215
Blackberries	40.0	0.7	0.8	....	56.4[1]	2.1	248
Blueberries, canned	85.6	0.4	0.6	....	12.8[1]	0.6	59
Cherries	77.2	0.5	1.1	....	21.1[1]	0.1	90
Cherry jelly	21.0	0.7	1.1	....	77.2[1]	....	....
Figs, stewed	56.5	1.1	1.2	....	40.9[1]	0.3	171
Grape butter	36.7	3.5	1.2	....	58.5[1]	0.1	240
Grape fruit, canned	90.5	0.4	0.5	0.2	8.3	0.1	36
Marmalade, orange	14.5	0.3	0.6	....	84.5[1]	0.1	341
Peaches	88.1	0.3	0.7	....	10.8[1]	0.1	47
Pears	81.1	0.3	0.3	....	18.0[1]	0.3	76
Pineapples	61.8	0.7	0.4	....	36.4[1]	0.7	154
Prune sauce	76.6	0.5	0.5	....	22.3[1]	0.1	92
Strawberries, stewed	74.8	0.5	0.7	....	24.0[1]	....	....
Tomato preserves	40.9	0.7	0.7	....	57.6[1]	0.1	234
Nuts.							
Nuts:							
Almonds	4.8	2.0	21.0	2.0	15.3	54.9	639
Almond butter	1.6	3.0	22.1	3.9	7.9	61.5	674
Beechnuts	4.0	3.5	21.9	....	13.2[1]	57.4	657
Brazil nuts	3.3	3.4	16.8	2.1	5.0[2]	69.4	712
Butternuts	4.4	2.9	27.9	....	3.5[1]	61.2	676
Cashew nuts	4.5	2.5	19.1	0.6	26.2[1]	47.1	605
Chestnuts	45.0	1.3	6.2	1.8	40.3	5.4	235
Coconut	14.1	1.7	5.7	....	27.9[1]	50.6	590
Coconut milk	92.7	0.8	0.4	....	4.6	1.5	34
Coconut, prepared	3.5	1.3	6.3	....	31.5[1]	57.4	668
Filberts	3.7	2.4	15.6	....	13.0[1]	65.3	702
Hickory nuts	3.7	2.1	15.4	....	11.4[1]	67.4	714
Lichi nuts	17.9	1.5	2.9	....	77.5[1]	0.2	323

[1] Includes fiber.
[2] Includes 1.3 per cent water-soluble carbohydrate. No starch present.

TABLE I. ANALYSES OF COMMON FOODS—*Concluded.*

Description of food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
Nuts—Concluded.							
ts—*Concluded:*	%	%	%	%	%	%	
?eanuts	9.2	2.0	25.8	2.5	21.9	38.6	538
?eanut butter	2.1	5.0	29.3	....	17.1[1]	46.5	604
?ecans	2.7	1.9	9.6	....	15.3[1]	70.5	734
?ine nuts:							
Pignolias	5.8	4.2	36.5	0.8	4.8[2]	47.9	596
Piniones	3.8	2.8	6.5	....	26.2[1]	60.7	677
Pinon	3.4	2.8	14.6	....	17.3[1]	61.9	685
Sabine	5.1	4.7	28.1	....	17.3[1]	61.9	685
?istache nuts	5.7	2.8	24.3	1.8	14.3[3]	51.1	614
Valnuts, California	2.5	1.7	18.4	1.4	11.6	64.4	700
California, black	2.5	1.9	27.6	1.7	10.0	56.3	657
California, soft shell	2.5	1.4	16.6	2.6	13.5	63.4	691
Alcoholic Beverages.							
;tilled liquors[4] (whiskey, gin, um, brandy)	....	....	....	....	none or tr.	....	....
nes,[5] dry	....	....	....	....	0.3	....	....
sweet	....	....	....	....	8.0	....	....
rdials[6] (creme de menthe, kummel, benedictine, anisette, chartreuse)	....	....	....	....	30.0	....	....
;r,[7] near	....	....	....	....	5.0	....	....
;[7]	....	....	....	....	5.1	....	....
.lt extract, commercial	....	....	....	....	10.6	....	....
true (concentrated)	....	....	....	....	71.3	....	....
ler[8]	....	....	....	....	4.5	....	....
Other Beverages or Beverage Materials.							
a (0.5 oz. to 1 pt. water)	....	....	....	....	0.6	....	....
ffee (1 oz. to 1 pt. water)	....	....	....	....	0.7	....	....
coa, as purchased	6.2	5.5	18.3[9]	4.5	37.5[10]	26.7	464
coa (0.5 oz. to 1 pt. water)	....	....	....	....	1.1	....	....
(0.5 oz. to 1 pt. milk)	....	....	....	....	6.0	....	....
ocolate, as purchased	3.8	3.1	12.4[11]	2.8	24.8[12]	52.2	619
rbonated drinks (bottled soda, ,arsaparilla, birch beer, root beer, ;inger ale)	....	....	....	....	8.0	....	....

Includes fiber.
Includes 4.3 per cent water-soluble carbohydrate. No starch present.
Includes 6.1 per cent water-soluble carbohydrate. No starch present.
Sugar is sometimes added to brandy. One sample examined contained 33.5 per cent of ar. Range of alcohol content 35 to 50 per cent by volume.
Natural wines contain from 6 to 12 per cent alcohol; "fortified" wines, 15 to 20 per cent. wines contain from a trace to 3.6 per cent of sugar; sweet wines from 0.1 to 40.7 per cent.
Range of alcohol content 35 to 50 per cent.
Range of alcohol content formerly 3 to 5 per cent, now not over 0.5 per cent.
Range of alcohol content 2.5 to 6 per cent. Carbohydrate range 0 to 13.5 per cent.
Theobromine and caffeine (1.3 per cent), not included.
Includes about 14 per cent of starch and soluble carbohydrate; balance of carbohydrate doubtful or undetermined availability.
Theobromine and caffeine (0.9 per cent), not included.
Includes about 10 per cent of starch and soluble carbohydrate; balance of carbohydrate doubtful or undetermined availability.

TABLE II. ANALYSES OF SPECIAL FOODS.

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber)		Fat	Calories per 100 gms.
							Starch	Undetermined carbohydrate		
	Flours and Meals.									
	Acme Mills Co., Portland, Ore.	%	%	%	%	%	%	%	%	
1910	Acme Diabetic Flour	9.40	1.10	1.50	9.40	0.80	71.40	6.00	1.90	364
	Amthor & Co., Halle.									
1904	Weizen-Protein	8.60	1.10	13.46	76.70	....	12.20		1.40	368
	Herman Barker, Somerville, Mass.									
1906	Barker's Gluten Food "A"	10.10	0.20	13.66	77.90	0.00	4.50[1]	6.70	0.60	362
1912	Barker's Gluten Food "A"	7.40	0.40	13.90	79.20	0.20	trace	12.30	0.50	370
1919	Barker's Gluten Food "A"	9.86	0.29	13.50	76.95	0.06	2.56	9.84	0.44	361
1906	Barker's Gluten Food "B"	10.10	0.20	13.50	77.00	0.00	6.00[1]	6.10	0.60	362
1913	Barker's Gluten Food "B"	6.30	0.40	13.62	75.20	0.40	3.70	13.40	0.60	375
1919	Barker's Gluten Food "B"	9.72	0.33	12.98	73.99	0.08	5.23	10.14	0.51	362
1906	Barker's Gluten Food "C"	9.70	0.20	13.20	75.20	0.00	8.30[1]	5.80	0.80	364
1913	Barker's Gluten Food "C"	5.70	0.40	13.46	76.70	0.60	3.40	12.60	0.60	377
1919	Barker's Gluten Food "C"	10.00	0.42	12.79	72.90	0.09	6.39	9.80	0.40	360
	Battle Creek Sanitarium Co., Battle Creek, Mich.									
1916	Gluten Meal	7.55	1.35	4.61	26.28	0.12	55.03	8.65	1.02	369
1916	Gluten Meal	7.35	1.20	6.90	39.33	....	41.12	10.08	0.92	370
1914	Gluten Meal 80%	6.83	....	13.44	76.61	....	5.77	....	....	...
	Battle Creek Food Co., Battle Creek, Mich.									
1925	Gluten Flour	8.08	0.93	7.57	43.15	0.34	39.33[2]	6.35	1.82	372
	Bischof & Co., London.									
1907	Gluten Flour	10.10	1.30	12.77	72.80	0.20	12.00		3.60	372

	Callard, Stewart & Watt, London.									
1906	Casoid Flour	10.00	2.50	13.70	85.60	....	none	1.40[3]	0.50	353
1909	Casoid Flour	10.30	2.50	13.20	82.50	....	none	3.10[3]	1.60	357
1916	Gluten Flour	9.70	....	12.88	73.40	....	none	....	....	...
	Canada Cereal & Flour Co.									
1919	Gluten Flour	12.02	2.61	3.26	18.58	1.50	43.87	16.94	4.48	358
	Cereal Meal Corporation, St. Louis, Mo.									
1923	Cereal Meal	6.39	4.60	3.07	19.19	5.13	34.77[4]	23.35	6.57	368
	Cereo Co., Tappan, N. Y.									
1912	Soy Bean Gruel Flour	4.90	4.40	7.31	45.70	1.90	0.60	22.00	20.50	458
1913	Soy Bean Gruel Flour	4.20	4.20	6.90	43.10	2.20	trace	24.90	21.40	465
1919	Soy Bean Gruel Flour	6.12	3.98	7.38	46.13	2.38	0.90	21.86	18.63	443
	Cheltine Food Co., Cheltenham, England.									
1923	Cheltine Diabetic Food	4.66	6.89	9.26	57.88	0.78	16.40[5]	3.34	10.05	401
	Curdolac Food Co., Waukesha, Wis.									
1924	Curdolac Flour	4.98	7.78	6.58	41.13	6.53	4.60[6]	22.54	12.44	385
	The Dieto Food Co., New York City.									
1914	Flour, Pure Whole Wheat	7.85	1.15	2.36	13.45	1.01	62.44	11.99	2.11	371
	Efficiency Products Co., Somerville, N. J.									
1926	Hoffman's Casein Flour	15.55	7.23	11.44	72.99	0.03	0.68[7]	2.48	1.04	314
	Empire Flour Mills.									
1919	Gluten Flour	10.46	0.48	2.30	13.11	0.25	59.08	15.48	1.14	361
	Farwell & Rhines, Watertown, N. Y.									
1906	Cresco Flour	12.70	0.50	1.78	11.10	....	....	74.80	0.90	352
1913	Cresco Flour	12.70	0.40	2.90	18.10	0.40	57.20	10.20	1.00	351
1913	Cresco Flour	....	....	3.22	20.10	....	....	....	....	...
1904	Gluten Flour	....	....	1.50	8.55	....	much	....	....	...

[1] Includes water-soluble carbohydrates.
[2] Includes 2.88 per cent water-soluble carbohydrates.
[3] Includes fiber.
[5] Includes 7.76 per cent water-soluble carbohydrates.
[6] Includes 3.76 per cent water-soluble carbohydrates
[7] All water-soluble carbohydrates.

TABLE 11. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Carbohydrate (other than fiber) Undetermined carbohydrate	Fat	Calories per 100 gms.
	Flours and Meals—Continued.									
	Farwell & Rhines, Watertown, N. Y.—Concluded.	%	%	%	%	%	%	%	%	
1906	Gluten Flour	12.70	0.40	1.82	10.40	0.30	71.50[1]	3.80	0.90	351
1906	Gluten Flour	13.30	0.50	1.73	9.90	0.10	72.00[1]	3.20	1.00	349
1909	Gluten Flour	10.70	0.50	1.92	10.90	....	77.40[2]		0.50	358
1913	Gluten Flour	8.30	0.60	6.90	39.30	0.20	38.10	12.30	1.20	370
1913	Gluten Flour	8.60	0.50	7.41	42.20	0.60	32.80	14.20	1.10	367
1916	Gluten Flour	10.65	0.45	3.06	17.44	0.04	63.39	7.05	0.98	360
1916	Gluten Flour	7.05	0.35	7.04	40.13	....	41.35	10.12	1.00	366
1919	Gluten Flour	10.93	0.34	3.64	20.75	trace	54.09	12.55	1.34	362
1919	Gluten Flour	11.14	0.57	3.84	21.89	trace	55.71	9.41	1.28	360
1919	Gluten Flour	9.34	0.52	7.16	40.82	trace	32.17	15.75	1.40	368
1919	Gluten Flour 40%	9.09	0.55	6.90	39.32	trace	37.75	12.03	1.26	368
1919	Gluten Flour 40%	10.65	0.75	7.10	40.47	0.23	37.01	9.42	1.47	361
1923	Gluten Flour	8.81	0.65	7.10	40.47	0.34	43.24[3]	5.12	1.37	368
1925	Gluten Flour	8.23	0.72	7.38	42.07	0.29	40.99[4]	6.30	1.40	370
1904	Special Diabetic Food	....	....	2.16	13.50	....	much	....	....	...
1906	Special Diabetic Food	12.00	1.90	2.29	14.30	1.40	58.30[1]	9.10	3.00	354
1906	Special Diabetic Food	10.30	1.60	2.27	14.20	1.10	62.10[1]	7.90	2.80	362
1906	Special Diabetic Food	12.40	1.30	2.05	12.80	0.60	70.30		2.60	358
1913	Special Diabetic Food	9.60	1.80	4.40	27.50	1.70	40.00	16.60	2.80	362
	Federal Mill & Elevator Co., Lockport, N. Y.									
1923	Gluten Flour	9.20	0.90	6.76	38.53	0.41	42.30[5]	6.88	1.78	367
	Gericke, Potsdam.									
1910	Aleuronat	9.30	0.90	13.34	76.04	....	10.46[2]		3.30	376

	Golden Rod Milling Co., Portland, Ore.									
1913	Acme Special Flour	10.00	0.70	2.53	15.80	0.70	57.00	13.50	1.40	361
1919	Acme Special Flour	11.73	1.02	2.42	15.13	0.33	61.48	8.56	1.75	356
1916	Gluten Flour	12.12	....	2.47	14.08	....	66.97	....	1.25	...
	O. B. Gilman, Boston, Mass.									
1913	Gluten Flour	8.70	1.00	7.57	43.20	0.60	31.40	13.10	2.00	369
	Karl Goldscheider, Carlsbad.									
1909	Conalbin-Mehl No. 1	9.40	0.50	1.74	10.90	....	78.80[3]		0.40	362
	Gumpert, Berlin.									
1910	Ultramehl	6.60	2.90	5.84	36.50	....	9.40[2]		44.60	585
1908	Wheat Protein, Hazard's	7.00	0.60	6.69	38.10	0.30	52.80		1.20	374
	The Health Food Co., New York City.									
1906	Almond Meal	8.50	6.40	8.10	50.60	2.90	7.20[1]	8.80	15.60	407
1913	Almond Meal	7.90	6.30	8.05	50.30	2.80	trace	17.90	14.80	406
1914	Almond Meal	7.16	5.48	7.86	49.13	0.48	none	15.91	21.84	457
1919	Almond Meal	7.90	6.01	8.04	50.25	2.40	none	18.00	15.44	412
1919	Bran Biskue, Gluten Bran	9.19	3.38	4.85	27.65	1.51	33.84	13.90	10.53	396
1911	C. B. X. Cold Blast Flour, 25% Protein	8.70	0.50	1.62	10.10	0.20	68.90	10.70	0.90	367
1919	Diabetic Casein Flour (self-raising)	11.93	9.16	11.56	72.25	0.14	none	5.73	0.79	319
1914	Gluten Flour No. 1	7.65	2.78	12.11	69.03	0.21	7.09	12.36	0.88	362
1916	Gluten Flour	7.70	....	7.28	41.50	....	35.00	....	....	...
1919	Gluten Flour 40%	8.48	0.65	6.88	39.21	0.35	37.27	12.99	1.05	371
1906	Glutosac Gluten Flour	10.10	1.10	5.45	31.10	1.00	49.30[1]	5.80	1.60	359
1909	Glutosac Gluten Flour	8.00	1.10	5.65	32.20	....	58.10[5]		0.60	367
1911	Glutosac Gluten Flour	8.70	....	5.86	33.40	....	....	....	....	...
1913	Glutosac Gluten Flour	8.20	1.40	6.38	36.40	0.70	36.90	14.10	2.30	370
1914	Glutosac Gluten Flour	8.18	1.20	6.08	34.65	0.48	41.96	11.84	1.69	369
1919	Glutosac Gluten Flour	10.53	0.75	7.28	41.50	0.29	36.20	9.05	1.68	362
1913	Pronireu (Gluten Griddle Cake Flour)	8.80	4.90	5.97	34.00	0.50	37.70	12.90	1.20	349
1919	Pronireu (Gluten Griddle Cake Flour)	10.81	4.26	6.64	37.85	0.20	36.56	9.14	1.18	345

[1] Includes water-soluble carbohydrates.
[2] Includes fiber.
[3] Includes 4.34 per cent water-soluble carbohydrates.
[4] Includes 3.08 per cent water-soluble carbohydrates.
[5] Includes 2.70 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Undetermined carbohydrate	Fat	Calories per 100 gms.
	Flours and Meals—Continued.									
	The Health Food Co., New York City—Concluded.	%	%	%	%	%	%	%	%	
1906	Protosac Gluten Flour	10.60	0.70	5.86	33.40	0.30	50.00[1]	4.10	0.90	358
1913	Protosac Gluten Flour	8.00	0.90	6.83	38.90	0.30	36.30	13.90	1.70	372
1914	Protosac Gluten Flour	8.16	1.30	7.35	41.90	0.38	31.50	14.80	1.96	370
1913	Protosoy Soy Flour	3.00	5.00	6.77	42.30	5.40	trace	24.50	19.80	446
1914	Protosoy Soy Flour	3.86	5.30	6.86	42.88	2.75	1.86	24.17	19.18	448
1919	Protosoy Soy Flour	6.32	4.43	6.30	39.38	4.33	1.86	25.10	18.58	433
1906	Pure Washed Gluten Flour	6.20	0.80	9.98	56.90	0.20	27.50[1]	7.50	0.90	376
1913	Pure Washed Gluten Flour	6.10	0.50	12.85	73.20	0.40	7.00	11.20	1.60	380
1914	Pure Washed Gluten Flour	7.03	0.58	13.70	78.09	0.40	2.81	10.08	1.01	373
1919	Pure Washed Gluten Flour	8.31	0.71	13.14	74.90	0.30	3.77	10.04	1.97	373
1922	Pure Washed Gluten Flour	7.10	....	14.05	80.09	....	3.36[2]	....	....	...
1919	Snow Flake Diabetic Casein Flour	10.41	6.07	12.67	79.19	....	none	3.18	1.15	340
	R. Hundhausen, Hamm.									
1892	Aleuronat (pure)	8.50	0.90	13.78	78.55	....	11.55		0.50	365
1892	Aleuronat (less pure)	9.10	1.20	12.43	70.85	0.20	17.45		1.20	364
	Hudon Hebert (furn'r).									
1919	Gluten Flour	11.84	1.24	2.52	14.36	1.30	52.20	16.84	2.22	354
	Jireh Diabetic Food Co., New York City.									
1906	Diabetic Flour	9.30	1.30	2.29	14.30	1.00	66.60[1]	5.30	2.20	365
1906	Diabetic Flour	11.00	1.30	1.94	12.10	1.10	72.70		1.80	355
1919	Diabetic Flour	10.36	1.04	2.60	14.82	1.00	50.13	20.69	1.96	360
1919	Diabetic Flour	12.03	1.01	2.49	14.22	1.05	50.62	18.55	2.52	356
1913	Flour	7.60	1.40	2.30	14.40	1.40	60.90	12.00	2.30	370

1919	Gluten Flour	9.10	1.40	2.52	14.36	1.20	50.00	21.86	2.08	371
1919	Gluten Flour	11.34	1.34	2.50	14.25	1.60	48.66	20.41	2.40	355
1913	Patent Barley	5.00	1.10	1.82	11.40	0.70	67.80	12.40	1.60	381
1913	Patent Cotton Seed Flour	7.40	5.50	7.86	49.10	4.00	6.00	15.30	12.70	396
1913	Patent Lentils Flour	5.90	2.50	4.37	27.30	3.30	42.60	17.20	1.20	359
1913	Protein Flour	7.30	1.70	5.02	31.40	0.90	48.50	8.20	2.00	370
1913	Soja Bean Flour	4.40	4.60	6.77	42.30	4.70	0.00	25.80	18.20	435
1906	Wheat and Barley Flour	9.70	1.50	1.89	11.80	1.60	66.20[1]	7.30	1.90	358
1906	Wheat and Barley Flour	9.50	1.60	1.81	11.30	1.40	74.40		1.80	359
1924	Soycasein Flour	9.16	5.81	12.13	75.81	0.30	1.36[3]	4.58	2.98	354
	Jireh Food Co., Inc., Morris Plains, N. J.									
1925	"Starch-Treated" Flour	8.08	1.36	2.14	13.38	1.29	65.95[4]	7.89	2.05	367
	Johnson Educator Food Co., Boston, Mass.									
1906	Educator Standard Gluten Flour	11.30	1.00	4.22	24.10	0.40	56.80[1]	4.70	1.70	358
1911	Educator Standard Gluten Flour	7.30	0.80	6.42	36.60	0.20	40.90	12.80	1.40	374
1911	Educator Standard Gluten Flour	8.80	....	6.42	36.60	....	....	....	....	...
	The Kellogg Food Co., Battle Creek, Mich.									
1904	20% Gluten Meal	10.50	1.00	2.53	14.40	0.40	57.40	15.70	0.60	355
1909	20% Gluten Meal	8.90	1.10	3.36	19.20	....	70.00[5]		0.80	364
1912	20% Gluten Meal	9.80	1.40	4.40	25.10	0.10	49.60	13.50	0.50	357
1916	20% Gluten Meal	7.65	1.22	4.33	24.68	0.12	51.24	14.17	0.92	369
1906	40% Gluten Flour	10.50	0.50	6.45	36.80	0.20	46.90[1]	3.90	1.20	361
1906	40% Gluten Flour	8.50	1.40	6.14	35.00	0.10	50.00[1]	3.80	1.20	366
1909	40% Gluten Flour	7.90	1.20	6.24	35.60	....	53.50[5]		1.80	373
1912	40% Gluten Flour	9.70	1.40	7.52	42.90	0.20	31.90	13.00	0.90	359
1913	40% Gluten Flour	8.00	1.20	6.99	39.80	0.20	40.50	9.40	0.90	367
1916	40% Gluten Flour	8.62	0.89	5.90	33.63	0.08	48.04	7.31	1.43	369
1919	40% Gluten Flour	10.10	0.63	8.28	47.20	0.26	30.66	10.17	0.98	261
1909	40% Gluten Flour, Self-Raising	8.80	1.30	6.19	35.30	....	53.60[5]		1.00	365
1916	Gluten Meal	7.30	1.36	7.29	41.55	0.10	36.59	11.99	1.11	371
1919	40% Gluten Meal, Thoroughly Cooked	8.50	1.38	7.54	42.98	0.31	33.38	12.00	1.45	380
1909	80% Gluten	7.20	0.60	12.61	71.90	....	19.40[5]		0.90	373

[1] Includes water-soluble carbohydrates.
[2] Includes 0.55 per cent water-soluble carbohydrates.
[3] All water-soluble carbohydrates.
[4] Includes 5.48 per cent water-soluble carbohydrates.
[5] Includes fiber.

SPECIAL FOODS—Continued.

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber): Starch	Carbohydrate (other than fiber): Undetermined carbohydrate	Fat	Calories per 100 gms.
	Flours and Meals—Continued.									
	The Kellogg Food Co., Battle Creek, Mich.—Concl.	%	%	%	%	%	%	%	%	
[illegible]	80% Gluten	9.10	0.60	13.01	74.20	0.20	6.20	8.80	0.90	365
1916	Gluten Meal	5.10	0.45	12.90	73.53	0.18	3.10	15.88	1.76	386
1916	Pure Gluten Meal	4.60	0.96	13.47	76.78	0.08	6.77	10.00	0.81	374
1919	Pure Gluten Meal	7.73	0.92	13.88	79.12	0.19	2.56	8.74	0.74	368
	Lister Bros., New York City.									
1917	Lister's Diabetic Flour, Self-rising	11.62	2.77	10.78	67.38	0.17	none	17.20	0.86	346
1919	Lister's Diabetic Flour, Self-rising	11.53	9.44	10.93	68.31	0.05	none	9.72	0.95	321
	Lyster Bros., Whitefield, N. H.									
1915	Casein Flour	5.70	5.78	13.52	84.50	0.05	none	0.37	3.60	381
1916	Diabetic Flour	6.58	7.90	12.68	79.25	....	none	....	3.00	...
	Eugene Loeb, New York City.									
1913	Gluten Cracker Meal	9.70	1.00	4.45	25.40	0.30	40.20	15.70	7.70	394
1913	Imported Gluten Flour	9.20	1.40	12.21	69.60	0.40	4.40	14.10	0.90	361
1913	Pure Gluten Flour	10.10	0.60	6.45	36.80	0.30	39.60	10.20	2.40	368
1913	Whole Wheat Flour	11.10	1.10	2.34	13.30	0.50	54.60	17.20	2.20	360
	E. Loeb & Co., New York City.									
1913	Gluten Flour	9.80	0.50	7.02	40.00	0.30	39.80	8.50	1.10	363
1919	Gluten Flour	9.72	0.48	6.12	34.86	0.20	39.87	14.11	0.76	362
	Loeb's Diabetic Food Bakery, New York City.									
1916	Gluten Cracker Meal	8.22	1.07	6.82	38.87	0.19	31.59	11.14	8.92	407
1919	Gluten Cracker Meal	8.40	1.59	6.44	36.71	0.28	30.66	11.48	10.88	417

1919	Gluten Cracker Meal	7.94	1.39	6.46	36.82	0.30	32.17	12.43	8.95	406
1916	Pure Gluten Flour	8.85	0.51	7.65	43.61	0.13	35.78	10.11	1.01	333
1919	Pure Gluten Flour	10.48	0.89	6.80	38.76	0.15	38.22	10.30	1.20	360
1923	Pure Gluten Flour	8.22	0.83	7.28	41.50	0.15	39.72[1]	7.39	2.19	374
1923	Special Gluten Flour	*5.76*	*0.77*	*12.84*	*73.19*	*0.19*	*9.42*[2]	*8.70*	*1.97*	383
	McDowell Bros., Ogdensburg, N. Y.									
1925	Diaban Flour	6.78	6.46	4.48	28.00	2.15	32.06[3]	6.48	18.07	429
1925	Diaban Flour	5.95	6.15	4.17	26.06	1.35	33.17[4]	9.97	17.35	431
	Thomas Martindale & Co., Philadelphia, Pa.									
1913	Special Gluten Flour	8.20	0.60	6.45	36.80	0.30	41.40	11.20	1.50	371
	Maple Leaf Milling Co.									
1919	Gluten Flour	12.52	0.38	2.22	12.66	0.25	61.51	11.52	1.16	353
	Mayflour Mills, Fort Wayne, Ind.									
1913	Bond's Diabetic Flour	9.40	0.60	6.43	40.20	0.20	40.60	7.70	1.30	366
1919	Gluten Flour	10.35	0.85	8.42	47.99	0.30	28.63	10.23	1.65	365
	A. McFarlane Co.									
1919	Gluten Flour	11.09	0.47	2.16	12.14	0.30	60.34	14.28	1.38	358
	P. McIntosh Co.									
1919	Gluten Flour	10.65	0.45	2.64	15.05	0.25	63.28	9.32	1.00	360
	Theo. Metcalf Co., Boston, Mass.									
1906	Soja Bean Meal, 5.5% Starch	7.80	4.40	6.38	39.90	3.90	9.00[3]	15.90	19.10	431
1906	Soja Bean Meal, 7.6% Starch	....	....	5.89	36.80	....	....	....	....	...
1913	Soja Bean Meal, 18.0% Starch	6.50	4.10	6.56	41.00	3.40	25.00		20.00	444
1906	Vegetable Gluten, 20.0% Starch	7.90	0.70	9.82	56.00	0.30	26.80[3]	6.70	1.60	372
1913	Vegetable Gluten, 8.1% Starch	7.60	0.50	12.86	73.30	0.20	5.90	11.00	1.50	374
	H. Niemöller, Gütersloh.									
1901	Roborat	9.50	1.40	13.17	82.30	0.20	2.90		3.70	374

[1] Includes 3.04 per cent water-soluble carbohydrates.
[2] Includes 0.76 per cent water-soluble carbohydrates.
[3] Includes water-soluble carbohydrates.
[4] Includes 5.04 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Carbohydrate (other than fiber) Undetermined carbohydrate	Fat	Calories per 100 gms.
	Flours and Meals—Continued.									
	Northwestern Cereal Co., London, Ont.	%	%	%	%	%	%	%	%	
1916	Gluten Flour	8.50	....	2.07	11.80	....	60.60	....	....	...
1916	Gluten Flour	11.10	....	2.42	13.79	....	54.68	....	....	...
1916	Gluten Flour	9.30	....	2.03	11.57	....	53.20	....	....	...
1919	Gluten Flour	10.21	2.10	2.99	17.07	1.58	42.10	21.95	4.99	369
1916	Gluten Flour	12.77	....	1.78	10.14	....	64.80	....	2.02	...
1919	Gluten Flour, 40%	11.66	2.27	2.49	14.20	2.40	38.65	25.56	5.26	361
	Norton-Truax, Chicago, Ill.									
1919	Diaprotein	11.72	6.35	12.44	77.75	....	none	2.72	1.46	333
	Phospho Food Co., Los Angeles, Calif.									
1914	Phospho D. & D. Special	8.74	1.22	2.19	13.69	1.24	58.57	14.35	2.19	366
	Pieser-Livingston Co., Chicago, Ill.									
1913	Gluten Flour	8.50	0.60	6.93	39.50	0.10	38.40	11.60	1.30	370
1913	Gluten Flour	8.70	0.60	6.69	38.10	0.20	36.50	14.50	1.40	369
1919	Genuine Gluten Flour	10.16	0.81	7.26	41.38	0.20	36.31	9.79	1.35	362
1925	Gluten Flour	8.78	0.89	7.37	42.01	0.30	39.39[1]	6.96	1.69	369
	Plasmon, Ltd., London.									
1923	Plasmon Arrowroot	12.98	2.20	3.17	19.81	0.11	62.24[2]	2.53	0.13	340
	Potter & Wrightington, Boston, Mass.									
1919	Diet-Ease Gluten Flour	12.50	0.98	4.64	26.45	0.73	46.89	10.29	2.16	354
1919	Diet-Ease Gluten Flour	8.76	0.96	6.94	39.56	0.42	36.20	11.78	2.32	371
1925	Diet-Ease Gluten Flour	7.93	1.18	7.12	40.58	0.44	38.38[3]	8.89	2.60	375
1925	Diet-Ease Gluten Flour	7.74	1.76	7.03	40.07	0.46	40.60[4]	6.54	2.83	374

	The Pure Gluten Food Co., New York City.									
904	Gum Gluten Flour	....	....	8.69	49.53	....	....	....	....	...
911	Gum Gluten Flour	8.10	1.00	6.13	34.90	0.20	42.40	11.80	1.60	371
902	Gum Gluten Ground	11.90	0.90	4.29	24.50	....	61.30[5]		1.40	356
904	Gum Gluten Ground	10.60	0.80	7.05	40.20	0.40	30.00	16.70	1.30	359
906	Gum Gluten Ground	6.90	1.00	8.02	45.70	0.50	38.60[6]	5.40	1.90	376
908	Gum Gluten Self Raising	9.80	3.80	5.04	28.70	0.30	56.00		1.40	351
906	Gum Gluten Self Raising	10.80	4.50	6.06	34.50	0.50	42.90[6]	5.80	1.00	342
906	Hoyt's Gum Gluten	11.20	1.00	5.09	29.00	0.30	52.00[6]	4.90	1.60	358
914	Hoyt's Gum Gluten Flour, 59%	6.61	0.70	7.95	45.32	0.33	37.07	8.82	1.15	375
914	Hoyt's Gum Gluten Flour, Ground	8.21	0.60	6.71	38.24	0.18	42.61	9.23	0.93	369
914	Hoyt's Gum Gluten Self Raising Flour	7.30	3.88	6.83	38.93	0.40	38.98	9.76	0.75	357
914	Hoyt's Gum Gluten Special Flour	5.63	0.93	14.51	82.70	0.35	2.17	7.50	0.72	376
923	Hoyt's Gluten Flour	7.40	0.99	9.32	53.12	0.42	31.38[7]	3.43	3.26	381
925	Hoyt's Gluten Flour	8.23	0.94	7.56	43.09	0.28	40.41[8]	5.20	1.85	371
901	Plain Gluten Flour	9.90	0.60	8.58	48.90	0.20	34.50		5.90	363
911	Pure Gluten Flour	....	....	6.06	34.54	....	....	....	....	...
911	Pure Gluten Flour	9.10	....	6.29	35.54	....	....	....	....	...
	The Pure Gluten Food Co., Columbus, Ohio.									
919	Hoyt's Gluten Flour over 40% protein	10.68	0.82	7.34	41.84	0.27	33.19	12.07	1.13	359
919	Hoyt's Gluten Self-raising Flour over 40% protein	10.18	3.85	7.28	41.50	0.50	33.38	9.72	0.87	346
919	Hoyt's Gluten Special Flour 80% protein	6.82	1.10	13.54	77.18	0.27	2.81	10.63	1.19	373
	Rademann's Nährmittelfabrik, Frankfurt.									
913	Diabetiker Mehl	9.60	0.80	6.06	37.90	0.20	46.80	3.90	0.80	362
	Ralston Health Food Co.									
905	Gluten Flour	12.80	0.60	2.40	13.70	0.60	70.30		2.00	354
902	Gluten Flour	11.90	0.90	2.53	14.40	....	72.30[5]		0.50	351

[1] Includes 4.04 per cent water-soluble carbohydrates.
[2] Includes 0.65 per cent water-soluble carbohydrates.
[3] Includes 4.80 per cent water-soluble carbohydrates.
[4] Includes 5.72 per cent water-soluble carbohydrates.
[5] Includes fiber.
[6] Includes water-soluble carbohydrates.
[7] Includes 2.24 per cent water-soluble carbohydrates.
[8] Includes 5.76 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber): Starch	Carbohydrate (other than fiber): Undetermined carbohydrate	Fat	Calories, per 100 gms.
	Flours and Meals—Concluded.									
	Schulenburg Oil Mill, Schulenburg, Texas.	%	%	%	%	%	%	%	%	
1925	Allison's Cotton Seed Flour	9.38	5.95	8.06	50.38	2.70	1.07	19.28	11.24	384
1921	Allison's Flour (Cotton Seed)	6.65	6.20	8.07	50.44	4.83	8.81[1]	15.18	7.89	369
1919	Baumgarten Process Allison Flour	8.08	5.67	8.00	50.00	3.47	1.13	21.61	10.04	381
	La Societe L'Aliment "Essentiel," Nanterre, France.									
1921	"Essential" Flour	7.89	1.58	3.14	19.63	0.27	58.43[2]	9.24	2.96	376
1921	Heudebert, Surazotized Gluten Flour	7.79	3.36	10.75	61.28	0.30	14.03[3]	10.94	2.30	366
1921	Heudebert, Gluten Flour with Cacao	7.46	3.63	9.40	53.58	1.00	13.76[4]	14.73	5.84	381
1921	Lacteous Flour	4.80	2.02	1.38	8.63	0.32	72.18[5]	8.48	3.57	389
	Soy Bean Products Co., San Francisco, Calif.									
1919	Soy Bean Flour A	7.65	4.71	6.69	41.81	1.98	0.34	24.07	19.44	440
1919	Soy Bean Flour B	7.91	5.08	7.04	44.00	2.07	0.76	25.98	14.20	411
	Sprague, Warner & Co., Chicago, Ill.									
1913	Richelieu Gluten Flour	8.70	0.50	7.95	45.30	0.20	31.60	12.50	1.20	368
	Still Rock Spa, Waukesha, Wis.									
1919	Curdolac Flour	10.25	3.99	9.06	56.63	3.79	5.09	17.89	2.36	335
	G. Van Abbott & Sons, London.									
1913	Almond Flour	4.00	3.00	3.94	24.60	1.90	none	7.90	58.60	657
1913	Gluten Flour	10.20	0.80	12.02	68.50	0.40	12.40	6.80	0.90	359
1913	Gluten Semola	10.10	2.80	8.22	46.90	0.40	28.20	8.70	2.90	361
	Vitae Health Food Co., Seattle, Wash.									
1924	Soya Manna	8.88	4.35	6.58	41.13	1.50	10.68[6]	14.45	19.01	436

	Waukesha Health Products Co., Waukesha, Wis.									
1917	Ayos, the Improved Soja Bean Flour	8.75	4.13	6.63	41.44	3.82	0.56	24.43	16.87	458
1914	Hepco Flour	6.96	5.05	6.72	42.00	5.05	9.02[5]	14.80	17.12	417
1919	Hepco Flour	8.09	4.31	7.04	44.00	2.15	0.90	21.41	19.14	438
	White Swan Spice Co., Toronto.									
1916	Diet Flour	10.20	....	2.06	12.90	....	60.75	....	....	...
1916	Diet Flour	11.25	0.90	1.65	10.30	0.10	67.84	7.95	1.66	359
1919	Diet Flour	11.47	0.70	1.52	8.66	0.55	61.29	16.05	1.28	356
1919	Gluten Flour	9.21	0.77	1.72	9.80	0.44	62.30	16.00	1.48	370
1919	Gluten Flour	10.50	0.75	1.56	8.89	0.46	62.00	15.95	1.45	360
1919	Gluten Flour	10.84	0.87	1.61	9.18	0.44	61.60	15.47	1.60	359
	Wilson Bros., Rochester, N. Y.									
1919	Genteel Brand Flour	11.60	0.98	4.70	29.38	0.26	49.16	6.23	2.39	361
1911	Gluten Flour, 4/7 Standard	11.10	....	3.18	18.10	....	....	....	....	...
1911	Gluten Flour, 4/7 Standard	9.70	....	3.12	17.80	....	....	....	....	...
1913	Gluten Flour, 4/7 Standard	11.00	1.20	3.33	19.00	0.30	54.60	11.80	2.10	361
1913	Gluten Flour, Self-Raising, 4/7 Standard	12.20	4.60	2.78	15.80	0.30	51.80	13.30	2.00	342
1919	Gluten Flour	10.52	0.74	8.04	45.83	0.36	28.63	11.91	2.01	364
	"Non-Nutritive" Flours, Fillers, etc.									
	Dietetic Cellulose Co., Chicago.									
1920	Cellu Flour	5.52	0.30	none	none	57.25	none	36.93[7]	trace	...
	Efficiency Products Co., Somerville, N. J.									
1924	Ecmo (cellulose) Flour	9.05	1.00	0.66	4.13	4.75	3.44[6]	77.00[7]	0.63	...
	Lister Bros., Inc., New York City.									
1924	Low Caloric Flour	7.55	6.10	0.63	3.94	5.24	1.76[6]	74.84[7]	0.57	...
	Nutrivoid Diabetic Flour Co., Brooklyn, N. Y.									
1924	Nutrivoid Flour	8.23	1.17	0.69	4.31	7.18	6.08[6]	72.11[7]	0.92	...
	Vitae Health Food Co., Seattle, Wash.									
1925	Cellulose Flour	9.95	4.18	1.85	11.56	32.33	3.76[6]	35.42[7]	2.80	...

[1] Includes 8.25 per cent water-soluble carbohydrates.
[2] Includes 9.30 per cent water-soluble carbohydrates.
[3] Includes 1.32 per cent water-soluble carbohydrates
[4] Includes 1.46 per cent water-soluble carbohydrates.
[5] Includes 40.96 per cent water-soluble carbohydrates.
[6] *All water-soluble* carbohydrates.
[7] Modified celluloses.

TABLE 11. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Undetermined carbohydrate	Fat	Calories per 100 gms.
	"Non-Nutritive" Flours, Fillers, etc.—Concl.									
	Miscellaneous.									
1923	Cellulose Flour from Corn Cobs	% 5.00	% 0.82	% 0.16	% 1.00	% 63.80	% 0.34	% 28.50	% 0.54	...
	Bran, etc.									
	The Battle Creek Food Co., Battle Creek, Mich.									
1924	Cooked Bran	4.15	7.46	2.45	15.31	9.19	59.20		4.69	340
	Callard & Co., London.									
1925	Washed Bran	8.60	4.37	1.66	10.38	21.48	2.31[1]	46.41	6.45	294
	Lister Bros., New York City.									
1924	Lister's Starch-free Bran	8.16	4.30	2.62	16.38	21.14	1.63[2]	44.37	4.02	286
	The Spa, Waukesha, Wis.									
1924	Malted Bran	3.24	2.94	1.56	9.75	17.91	2.01[2]	58.60	5.55	331
	Vitae Health Food Co., Seattle, Wash.									
1925	Vitae Special Starch-free Bran	9.75	4.39	3.58	22.38	20.98	5.80[1]	27.77	8.93	304
	Woman's Baking Co., Boston, Mass.									
1921	Washed Bran	9.13	....	1.79	11.19	....	4.59[2]	....	7.39	130
	Experimental.									
1921	Bran, unwashed	6.05	6.31	2.62	16.38	6.05	12.21[3]	46.86	6.14	357
1921	Bran, washed	....	....	....	....	....	2.29[4]	....	....	...
	Efficiency Products Co., Somerville, N. J.									
1926	Starch-free Bran	12.33	3.65	2.67	16.69	19.71	2.41[2]	40.81	4.40	279

	Protein Preparations. *The Bauer Chemical Co., Berlin.*									
1912	Sanatogen	10.00	5.60	12.82	80.10	....	4.20[5]		0.10	338
	Cheltine Food Co., Cheltenham, Eng.									
1923	Cheltine Milk Protein	9.05	3.08	13.24	84.47	none	0.19[6]	2.24	0.97	356
1923	Cheltine Milk Protein	....	....	13.38	85.36	....	....	....	....	...
	Eiweiss Extrakt Co., Altona, Germany.									
1900	Soson	6.40	1.00	14.59	91.20	....	1.10[5]		0.30	372
	Glogau & Co., Chicago. (Sole Agents.)									
1923	Aleuronat	8.11	0.76	12.46	71.02	0.26	10.68[7]	3.59	5.58	391
1923	Aleuronat	....	....	12.46	71.02	....	....	....	....	...
	Krecke & Co., Salzuflen.									
1902	Energin	9.10	1.00	13.41	83.80	0.30	1.30		4.50	381
	Menley & James, New York City.									
1913	Glidine	5.70	0.90	14.62	83.30	0.20	none	9.10	0.80	377
	John Norton Co., Columbus, Ohio.									
1922	Diaprotein No. 2	11.23	6.75	12.43	79.30	....	0.88[6]	....	1.55	335
	Plasmon Co., London.									
1899	Plasmon (average 9 analyses)	11.90	7.50	11.23	64.00	....	15.90[5]		0.70	326
1901	Plasmon	8.50	7.40	12.00	68.40	....	15.50[6]		0.20	337
1908	Plasmon	12.40	7.70	11.25	64.10	....	15.40[6]		0.40	322
1909	Plasmon	10.90	7.60	12.59	70.10	....	8.70[5]		2.70	339
1923	Plasmon Milk Proteid	12.13	7.92	11.90	75.92	none	1.44[6]	1.87	0.72	323
	Troponwerke, Mülheim.									
1898	Tropon (average of many analyses)	9.30	1.20	13.86	86.60	....	2.70[5]		0.20	359
1901	Tropon	9.20	0.80	14.16	88.50	....	1.20[5]		0.30	362

[1] All water-soluble carbohydrates; no starch.
[2] Includes water-soluble carbohydrates.
[5] Includes fiber.
[6] Lactose.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Carbohydrate (other than fiber) Undetermined carbohydrate	Fat	Calories per 100 gms.
	Soft Breads.									
	American System of Bakeries, Hartford, Conn.	%	%	%	%	%	%	%	%	
1921	Gluten Bread	35.29	1.65	6.52	26.16	0.30	23.79[1]	6.84	5.97	281
1921	Gluten Bread A	30.43	1.79	6.60	27.75	0.41	27.58[2]	6.12	5.92	299
1921	Gluten Bread B	30.85	1.60	6.81	28.54	0.43	27.49[3]	5.65	5.44	296
	Barker System of Bakeries, Hartford, Conn.									
1925	Gluten Bread	38.71	1.91	2.93	16.68	0.40	32.30[4]	6.45	3.55	254
	Beroth Bread Shop, Hartford, Conn.									
1925	Gluten Bread	33.28	2.65	5.02	28.60	0.42	23.32[5]	7.13	4.60	278
	Bibeau, Meriden, Conn.									
1925	Gluten Bread	38.87	2.31	1.51	8.58	0.92	41.81[6]	6.13	1.38	239
	Canada Bread Co., Toronto, Canada.									
1919	Gluten Bread	35.00	2.34	1.73	9.87	0.34	34.82	16.52	1.11	255
	Community Bake Shop, Norwich, Conn.									
1925	Gluten Bread	33.37	2.37	5.42	30.88	0.51	22.32[7]	5.76	4.79	279
	The Dieto Food Co., New York City.									
1914	Dieto Bread, Pure Whole Wheat	40.42	1.69	1.55	8.84	0.71	36.57	11.41	0.36	231
	Ferguson Bakery, Boston, Mass.									
1913	Gluten Bread	37.20	1.70	3.87	22.10	0.20	25.20	10.50	3.10	259
	Frank & Co., Bockenheim.									
1892	Protein-Roggenbrot	32.00	2.80	3.79	21.60	2.30	35.10		6.20	283
1892	Protein-Weizenbrot	31.90	2.70	3.74	21.30	2.20	45.60		6.30	284

	Fritz, Vienna.									
....	Aleuronatbrot	35.50	1.30	2.50	14.30	0.20	47.90		0.80	256
1910	Kleberbrot, Schwarz	....	....	3.44	19.60	....	50.50		....	...
1910	Litonbrot	....	....	6.18	38.60	....	15.40		....	...
	Fromm & Co., Dresden.									
1910	Conglutinbrot	....	....	2.93	18.30	....	47.30		....	...
1910	Litonbrot	....	....	5.73	35.80	....	14.30		....	...
	Gericke, Potsdam.									
1910	Doppel-Porterbrot	38.60	....	4.30	26.90	....	35.10		....	...
1910	Doppel-Porterbrot	38.90	1.10	3.50	21.90	....	36.60[8]		1.50	248
1910	Dreifach-Porterbrot	35.10	1.30	4.91	30.70	0.40	19.80	6.20	6.50	285
1910	Einfach-Porterbrot	30.50	1.60	2.85	17.80	....	48.30[8]		1.80	280
1910	Sifarbrot	39.60	2.20	5.97	37.30	0.60	12.30	2.70	5.30	257
	Karl Goldscheider, Carlsbad.									
1910	Sinamylbrot	39.10	3.50	4.51	28.20	4.40	17.30	2.90	4.60	235
	Gumpert, Berlin.									
1910	Diabetiker-Doppel-Schwarzbrot	27.90	1.60	2.54	15.90	0.50	39.40	2.60	11.80	348
1910	Diabetiker-Doppel-Schwarzbrot	25.60	1.60	2.96	18.50	....	41.90[8]		12.70	346
1910	Diabetiker-Doppel-Weissbrot	23.70	2.30	3.01	18.80	0.40	36.80	2.60	15.40	371
1910	Einfach-Schwarzbrot	30.10	1.40	2.50	15.60	....	49.50[8]		3.40	291
1910	Einfach-Weissbrot	29.40	1.50	2.59	16.20	....	46.40[8]		6.50	309
1910	Ultrabrot	27.90	3.10	4.51	28.20	0.80	6.80	1.00	32.20	434
	F. Günther, Frankfurt.									
1892	Kleberbrot	33.70	2.40	2.75	15.68	0.70	47.02		0.50	255
	Hallinan's Bakery, New Britain.									
1925	Gluten Bread	33.40	1.97	4.83	27.54	0.46	23.38[9]	7.50	5.75	287
	H. and R. Diabetic Foods, Bronx, N. Y.									
1924	Bread of Low Food Value	24.80	3.43	1.51	9.45	9.37	1.74[10]	27.92	23.29	...

[1] Includes 1.01 per cent water-soluble carbohydrates.
[2] Includes 2.33 per cent water-soluble carbohydrates.
[3] Includes 1.93 per cent water-soluble carbohydrates.
[4] Includes 5.92 per cent water-soluble carbohydrates.
[5] Includes [illegible] per cent water-soluble carbohydrates.
[6] Includes 7.79 per cent water-soluble carbohydrates.
[7] Includes 3.99 per cent water-soluble carbohydrates.
[8] Includes fiber.
[9] Includes 4.08 per cent water-soluble carbohydrates.
[10] Includes 0.75 per cent water-soluble carbohydrates.

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber)		Fat	Calories per 100 gms.
							Starch	Undetermined carbohydrate		
	Soft Breads—Continued.									
	Health Food Co., New York City.	%	%	%	%	%	%	%	%	
1906	Glutosac Bread	31.50	1.90	4.38	24.40	0.40	29.90[1]	9.20	2.70	278
1914	Glutosac Bread	37.20	1.64	4.34	24.74	0.82	22.17	11.33	2.10	252
1919	Glutosac Bread	28.28	1.72	4.86	27.70	1.49	26.78	10.33	3.70	293
1919	Glutosac Bread	23.10	1.95	5.22	29.75	0.84	29.53	12.26	2.57	309
1906	Protosac Bread	27.30	1.40	5.20	29.60	0.20	33.10[1]	6.80	1.60	292
1914	Protosac Bread	30.70	2.11	4.77	27.19	0.38	27.66	10.16	1.80	276
1919	Protosac Bread, No. 1	28.85	2.42	6.31	35.97	0.84	20.53	7.39	4.00	292
1919	Protosac Bread, No. 2	28.49	1.83	4.73	26.96	0.30	30.47	8.43	3.52	302
	J. Heinbockel & Co., Baltimore, Md.									
1914	Diabeto Bread for Diabetes	33.47	3.22	1.37	8.55	1.15	40.39	11.73	1.49	256
	Howland Co., Bridgeport, Conn.									
1921	Gluten Bread	31.74	2.25	5.80	23.51	0.41	34.16[2]	7.01	0.92	257
	R. Hundhausen, Hamm.									
1892	Aleuronatbrot, low gluten	39.60	1.60	2.77	15.80	0.60	42.10		0.30	234
	Jireh Diabetic Food Co., New York City.									
1906	Whole Wheat Bread	39.20	1.80	1.50	8.60	0.60	43.80[1]	5.60	0.40	236
1913	Whole Wheat Bread (not fresh)	21.80	2.50	1.98	11.30	0.60	44.90	18.20	0.70	304
	Keney Tower Bakery, Hartford, Conn.									
1925	Gluten Bread	37.79	3.19	3.61	20.57	0.34	29.80[3]	3.29	5.02	260
	Levine Bros., New Haven, Conn.									
1923	Gluten Bread	39.17	1.87	3.07	17.52	0.29	25.72[4]	11.68	3.75	253

	Eugene Loeb, New York City.									
1913	P. & L. Genuine Gluten Bread	31.40	1.60	1.66	9.50	0.30	44.20	10.40	2.60	280
	Loeb's Diabetic Food Bakery, New York City.									
1919	Caseine Bread	40.42	4.47	6.53	40.84	0.08	none	3.35	10.84	274
1919	Caseine Bread	39.73	4.35	6.57	41.05	0.09	trace	3.71	11.07	323
1923	Genuine Gluten Bread	30.21	1.83	5.71	32.57	0.24	27.16[5]	4.40	3.59	289
1919	Casein Muffins	30.82	4.89	7.32	45.74	0.15	none	7.03	11.37	313
1916	Genuine Gluten Bread	27.72	1.51	5.66	32.26	0.21	26.37	11.76	0.17	282
1919	Genuine Gluten Bread	32.01	1.80	4.98	28.39	0.28	28.56	6.86	2.10	273
1914	P. & L. Genuine Glubetic Bread	30.07	1.06	6.20	35.34	0.36	19.15	9.97	4.05	294
	Lyster Bros., Whitefield, N H.									
1915	Casein Bread	38.27	4.24	5.85	36.57	0.05	none	2.49	18.38	322
	Mory's Bakery, New Haven, Conn.									
1925	Gluten Bread	38.30	1.30	4.92	28.06	0.18	23.99[8]	4.30	3.87	260
	Rademann's Nährmittelfabrik, Frankfurt.									
1910	Diabetiker-Grahambrot	31.70	1.80	1.57	9.80	2.10	45.60	3.90	5.10	283
1910	Diabetiker-Schwarzbrot (dry)	....	....	6.05	37.80	....	33.30		....	...
1910	Diabetiker-Schwarzbrot	29.10	1.90	2.32	14.50	1.40	45.80	4.80	2.50	283
1910	Diabetiker-Schwarzbrot	33.60	1.90	2.38	14.90	....	47.70[7]		1.90	267
1910	Diabetiker-Weissbrot (dry)	....	....	6.94	43.40	....	28.10		....	...
1910	Diabetiker-Weissbrot	33.80	1.90	3.73	23.30	0.40	37.00	3.10	0.50	258
1910	"D-K." Brot (dry)	....	....	1.97	12.30	....	58.90		....	...
1892	Erdnuss-Brot	24.60	3.80	5.38	33.60	5.50	19.70		12.80	328
1910	Litonbrot	42.60	2.40	4.83	30.20	0.70	17.50	4.10	2.50	230
	Mrs. Root's Food Shop, New Haven, Conn.									
1925	Gluten Bread	35.91	1.00	5.06	28.85	0.20	23.91[8]	5.05	5.08	277
	Schaeffer Bros., Inc., Middletown, Conn.									
1925	Gluten Bread	34.22	2.69	4.87	27.75	0.43	25.06[9]	5.32	4.53	273

[1] Includes water-soluble carbohydrates.
[2] Includes 1.88 per cent water-soluble carbohydrates.
[3] Includes 2.55 per cent water-soluble carbohydrates.
[4] Includes 1.89 per cent water-soluble carbohydrates.
[5] Includes 1.70 per cent water-soluble carbohydrates.
[6] Includes 2.91 per cent water-soluble carbohydrates.
[7] Includes fiber.
[8] Includes 4.98 per cent water-soluble carbohydrates.
[9] Includes 4.87 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber)		Fat	Calories per 100 gms.
							Starch	Undetermined carbohydrate		
	Soft Breads—Concluded.									
	Schelte, Münster.	%	%	%	%	%	%	%	%	
1894	Aleuronatbrot	38.80	1.30	2.93	16.70	0.90	41.70		0.60	239
	Seidl, München.									
1910	Aleuronatbrot	28.00	....	3.50	20.00	....	49.20		0.30	280
1910	Kleberbrot	24.20	....	2.98	17.00	....	56.00		0.70	298
	Slinn-Shouldis Co.									
1919	Gluten Bread	35.00	0.69	1.62	9.20	0.17	39.00	13.36	2.58	269
	Troponwerke, Mülheim.									
1899	Tropon-Brot	42.10	....	3.12	19.50	....	....	....	....	...
	Washburn-Crosby Co. Minneapolis, Minn.									
1925	Gluten Bread	27.23	3.71	4.13	23.56	2.26	10.24[1]	13.49	19.51	365
	Weston Bakery, Boston, Mass.									
1915	Gluten Bread	....	....	3.34	19.04	....	28.16	....	....	...
	Miscellaneous.									
1921	Almond Gluten Bread	25.58	6.70	5.81	27.98	0.92	13.17[2]	8.26	17.39	354
1923	Cestus Bread, Gluten	34.26	1.15	1.97	11.23	0.14	48.38[3]	3.38	1.46	265
1921	Cottonseed-Wheat Bread	42.22	2.23	3.10	11.63	0.95	33.26[4]	8.08	1.63	227
1923	Gluten Bread	....	....	3.18	18.13	....	40.71[5]	....	....	...
1921	Soybean Bread	37.70	5.88	5.38	21.75	0.88	6.22[6]	9.53	18.04	312
	Hard Breads and Bakery Products.									
	James Aird.									
1916	Gluten Bread	8.10	2.05	2.25	13.13	0.70	59.75	15.91	0.72	360

	Arnaud, Inc., New York City.									
1921	Cassava Cakes	10.42	2.16	0.28	1.75	4.83	69.53[7]	11.08	0.23	332
	Bischof & Co., London.									
1907	Diabetic Gluten Bread	7.40	4.70	11.70	66.70	0.00	20.70		0.50	354
1907	Essentiel Bread for Super Alimentation	7.30	4.80	4.26	20.60	0.10	59.60		1.60	359
	Brusson Jeune, Villemur, France.									
1910	Gluten Bread	7.80	1.10	5.14	29.30	0.20	49.80	10.00	1.80	373
1912	Gluten Bread	12.70	0.80	5.97	34.00	0.30	40.10	10.30	1.80	354
1921	Gluten Bread	10.31	0.71	5.93	33.80	0.15	44.95[8]	0.38	3.77	350
	Callard, Stewart & Watt, London.									
1909	Almond Biscuit, Plain	3.70	3.20	4.53	28.30	....	36.80[9]		28.00	512
1909	Almond Shortbreads	4.20	3.50	3.12	19.50	....	20.70[9]		52.10	630
1916	Casoid Biscuits	7.52	....	8.99	56.18	....	trace	....	27.10	...
1906	Casoid Biscuits, No. 1	7.80	3.90	10.08	63.00	....	8.10[6]	....	17.30	440
1909	Casoid Biscuits, No. 1	7.20	2.50	10.37	64.80	....	8.70[9]		16.80	445
1913	Casoid Biscuits, No. 1	4.80	3.40	10.69	66.80	0.40	4.00	1.80	18.80	460
1908	Casoid Biscuits, No. 2	....	....	9.30	58.10	....	0.00	....	....	...
1909	Casoid Biscuits, No. 2	7.50	3.60	9.25	57.80	....	5.60[9]		25.50	483
1908	Casoid Biscuits, No. 3	....	....	8.75	54.70	....	trace	....	....	...
1909	Casoid Biscuits, No. 3	7.90	5.00	8.69	54.30	....	7.80[9]		25.00	473
1908	Casoid Dinner Rolls	....	....	12.93	80.80	....	3.30[3]	....	....	...
1909	Casoid Dinner Rolls	7.00	1.80	12.48	78.00	....	2.10[9]		11.10	420
1909	Casoid Lunch Biscuit	4.20	3.80	4.08	25.50	....	21.60[9]		44.90	593
1909	Casoid Rusk	5.40	4.50	5.92	37.00	....	20.80[9]		32.30	522
1909	Cocoanut Biscuit + Saccharin	2.60	3.10	2.66	16.60	....	16.40[9]		61.30	684
1909	Ginger Biscuit + Saccharin	2.50	3.70	2.74	17.10	....	18.10[9]		58.60	668
1909	Kalari Batons	8.10	4.40	8.46	52.90	....	0.90[9]		33.70	519
1913	Kalari Batons	4.50	5.20	6.91	43.20	0.70	none	7.40	39.00	553
1909	Kalari Biscuits	6.30	3.70	9.10	56.90	....	1.70[9]		31.40	517
1909	Prolactic Biscuits	6.30	4.00	6.86	42.90	....	19.30[9]		27.50	496

[1] Includes 1.58 per cent water-soluble carbohydrates.
[2] Includes 1.74 per cent water-soluble carbohydrates.
[3] Includes 4.29 per cent water-soluble carbohydrates.
[4] Includes 1.74 per cent water-soluble carbohydrates.
[5] Includes water-soluble carbohydrates.
[6] Includes 2.52 per cent water-soluble carbohydrates.
[7] Includes 2.76 per cent water-soluble carbohydrates.
[8] Includes 9.32 per cent water-soluble carbohydrates.
[9] Includes fiber.

TABLE II. ANALYSES OF SPECIAL FOODS—Continued.

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Undetermined carbohydrate	Fat	Calories per 100 gms.
	Hard Breads and Bakery Products—Cont.									
	Callard & Co., London—Concluded.	%	%	%	%	%	%	%	%	
1923	Almond Biscuits, No. 15	4.08	5.30	5.46	34.13	1.66	3.49[1]	2.79	48.55	599
1925	Bran and Agar Biscuits, "Cellulon"	10.15	4.51	1.75	10.94	15.93	10.90[2]	40.57	7.00	313
1923	Bran and Almond Biscuits	3.34	4.03	3.90	24.38	4.14	2.81[3]	3.81	57.49	641
1923	Casoid Biscuits, No. 17 A	6.04	8.95	9.32	58.25	0.13	0.32[4]	1.71	24.60	463
1923	Casoid Biscuits, No. 8	5.98	7.70	8.68	54.25	0.09	0.49[4]	4.91	26.58	478
1923	Chocolate Biscuits	3.74	4.11	4.18	26.13	1.50	5.57[5]	9.18	49.77	611
1925	Chocolate Biscuits (Casoid)	4.30	4.25	3.68	23.00	2.00	5.44[4]	9.43	51.58	616
1923	Gluten and Almond Biscuits, No. 11	5.42	2.58	10.46	65.38	0.29	3.08[6]	0.00	23.25	483
1923	Gluten Biscuits, No. 9	5.50	2.54	10.59	60.36	0.40	3.40[7]	3.90	23.90	486
1923	Gluten Cracknells, No. 7	6.18	2.12	12.06	68.74	0.24	3.36[8]	4.68	14.68	439
1923	Gluten Dinner Rolls, No. 6	6.89	1.52	12.94	73.76	0.18	5.16[9]	5.40	7.09	401
1923	Kalari Batons, No. 5	4.92	6.68	7.07	44.19	0.38	1.16[2]	0.13	42.54	565
1923	Parmesan Cheese Straws, No. 17	3.43	5.79	5.00	31.25	0.50	3.48[4]	6.61	48.94	606
1923	Ponos Biscuits, No. 14	7.55	8.44	9.69	60.56	0.33	1.25[4]	2.64	19.23	421
1923	Prolacto Biscuits, No. 12	5.76	8.82	9.56	59.75	0.22	0.26[4]	4.74	20.45	443
1923	Soup Sippets	1.89	7.70	8.66	54.13	0.03	0.52[4]	6.99	28.74	505
1925	Starchless Ginger Biscuits	3.83	3.41	4.38	27.38	1.28	2.68[2]	4.49	56.93	651
	Canada Bread Co., Toronto, Canada.									
1916	Gluten Health Bread	7.45	1.95	2.70	15.39	0.78	57.88	13.19	3.36	376
	Cheltine Food Co., Cheltenham, Eng.									
1923	Cheltine Assorted Biscuits	6.02	2.44	2.92	18.25	0.55	51.46[10]	5.28	16.00	444
1923	Cheltine Brown Rusks	8.02	2.14	2.91	18.19	0.22	50.97[11]	10.75	9.71	407
1923	Cheltine White Rusks	7.39	2.35	3.63	22.69	0.20	47.97[12]	4.61	14.79	434
1923	Manhu Diabetic Biscuits	5.97	1.07	2.07	12.94	0.80	61.71[13]	5.55	11.96	424

1925	Bran-Agar Agar Wafers	5.85	7.32	1.91	11.94	13.10	8.24[2]	47.86	5.69	...
1925	Cellu Bran Wafers	4.28	4.17	0.66	4.13	21.50	3.05[2]	38.63	24.24	...
1925	Cellu Cheese Wafers	3.48	3.21	1.24	7.75	21.15	2.31[2]	31.46	30.64	...
1925	Cellu Chocolate Wafers	4.08	3.43	1.04	6.5[illegible]	19.18	3.55[14]	34.93	28.33	...
	The Dieto Food Co., New York City.									
1914	Dieto Crackers	6.59	1.75	1.98	13.38	0.98	54.84	13.92	9.24	409
1914	Dieto Rusks	6.43	1.50	2.55	15.94	0.98	52.09	13.95	9.11	410
	Fougeron, Paris.									
1925	Pain Anti-diabetique	6.75	2.95	3.34	20.88	0.48	43.38[15]	5.51	20.05	460
	Frank & Co., Bockenheim.									
1892	Erdnuss-Kakes	6.40	2.70	5.15	32.20	3.10	36.50		19.10	447
	Fritz, Vienna.									
1910	Braunes Luftbrot "B"	....	....	6.82	42.60	....	19.80		....	...
1910	Mandelbrot	....	....	2.46	15.40	....	23.10		....	...
	Fromm & Co., Dresden.									
1913	Almond-form Wafers with Chocolate	2.60	1.00	0.77	4.80	0.30	14.00	48.30	29.00	529
1913	Butterbrezeln	6.30	2.00	1.97	12.30	0.20	43.10	19.60	16.50	449
1914	Conglutin Drops	6.49	5.23	8.13	50.81	0.23	29.19	6.94	1.11	358
1914	Conglutin-Zwieback	4.48	2.00	2.28	14.25	0.40	29.70	27.92	21.25	479
1913	Crackers	7.40	3.40	2.06	12.90	0.20	58.20	10.20	7.70	395
1913	Eierbiscuit	7.70	1.30	3.01	18.80	0.20	37.50	23.10	11.40	420
1910	Eiweissbrot	....	....	7.28	45.50	....	37.50		....	...
1913	Hazelnuss-Stangen	5.20	2.90	2.14	13.40	1.70	none	60.80	16.00	441
1913	Luft Bread	8.30	8.90	8.14	50.90	0.20	23.40	7.30	1.00	335
1913	Makronen	6.00	3.00	2.26	14.10	1.30	none	56.20	19.40	456
1913	Salz-Stangen	6.20	3.60	2.08	13.00	0.40	39.10	22.10	15.60	437

[1] Includes 3.10 per cent water-soluble carbohydrates.
[2] All water-soluble carbohydrates.
[3] *Includes 2.32 per cent water-soluble carbohydrates.*
[4] Includes water-soluble carbohydrates.
[5] Includes 3.74 per cent water-soluble carbohydrates.
[6] Includes 0.93 per cent water-soluble carbohydrates.
[7] Includes 0.98 per cent water-soluble carbohydrates.
[8] Includes 0.18 per cent water-soluble carbohydrates.
[9] Includes 0.60 per cent water-soluble carbohydrates.
[10] Includes 5.28 per cent water-soluble carbohydrates.
[11] Includes 5.55 per cent water-soluble carbohydrates.
[12] Includes 7.53 per cent water-soluble carbohydrates.
[13] Includes 9.12 per cent water-soluble carbohydrates.
[14] Includes 1.44 per cent water-soluble carbohydrates.
[15] Includes 9.04 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber): Starch	Carbohydrate (other than fiber): Undetermined carbohydrate	Fat	Calories per 100 gms.
	Hard Breads and Bakery Products—Cont.									
	Fromm & Co., Dresden—Concluded.	%	%	%	%	%	%	%	%	
1913	Stangenin	6.60	1.60	2.24	14.00	0.40	51.60	12.80	13.00	431
1910	Uni Bread	....	....	11.41	71.30	....	8.60		....	...
1913	Uni Bread	8.10	5.60	11.47	71.70	3.50	2.90	6.50	1.70	340
	Gericke, Potsdam.									
1910	Doppel-Porterzwieback	....	....	3.06	19.10	....	41.00		....	...
1910	Doppel-Porterzwieback	4.90	1.70	5.47	34.20	....	39.70[1]		19.50	471
1910	Mandelbrot	....	....	2.59	16.20	....	43.30		....	...
1910	Porterbiskuits	....	....	2.58	16.10	....	63.00		....	...
1910	Porterzwieback	....	....	4.22	26.40	....	72.00		....	...
1910	Sifarbiskuits	....	....	3.23	20.20	....	35.30		....	...
	Karl Goldscheider, Carlsbad.									
1914	Aleuronat-Conglutin Cakes	5.17	1.25	4.26	26.63	0.08	31.67	19.63	15.57	452
1914	Butter-Brezeln	5.16	1.83	1.68	10.50	0.08	43.93	23.64	14.86	446
1914	Feinste Cocoanuss-Biskuits für Diabetiker "3.6% carbohydrates"	2.71	2.73	5.50	34.44	0.88	0.00	13.86	45.38	602
1914	Feinste Vanille-Biskuits für Diabetiker, "3.6% carbohydrates"	3.14	2.85	7.42	46.38	0.55	none	16.75	30.33	525
1914	Honigküchen für Diabetiker, "3.6% carbohydrates"	2.98	3.05	6.45	40.31	1.00	none	13.91	38.75	566
1914	Saccharin-Oblaten ohne Zucker	5.42	2.43	2.64	16.50	1.95	33.47	17.63	22.60	474
1914	Tee-Gebäck	3.44	1.28	1.12	7.00	0.23	18.00	42.79	27.26	517
1914	Zwieback	6.85	2.70	3.41	21.31	0.23	51.69	13.61	3.61	379

	Groetzsch, Frankfurt.									
1910	Diabetiker-Salzbrezch	14.00	3.30	5.81	36.30	....	17.10[1]		29.30	477
1910	Diabetiker-Salzbrezch	5.30	1.60	5.52	34.50	0.30	22.90		35.40	548
1910	Pfeffernüsse	25.20	2.80	6.19	38.70	....	9.30[1]		24.00	408
1910	Pfeffernüsse	15.20	2.60	6.27	39.20	0.70	10.30		32.00	486
	Gumpert, Berlin.									
1910	Diabetiker-Stangen	5.50	2.90	4.98	31.10	....	11.00[1]		49.50	614
1910	Doppel-Diabetiker-Zwieback	4.60	2.50	5.20	32.50	0.80	27.10	0.40	32.10	529
	F. Gunther, Frankfurt.									
1892	Aleuronat-Kakes	5.10	0.80	2.38	13.60	0.40	70.80		9.30	421
1892	Aleuronat-Kakes	4.50	1.60	2.85	16.30	0.90	68.80		7.90	412
1897	Aleuronat-Kakes	4.50	1.50	2.45	14.00	....	71.30[1]		8.70	420
	H. and R. Diabetic Foods, Bronx, N. Y.									
1924	Bran Biscuits	11.47	4.04	1.06	6.62	6.26	2.16[2]	56.95	12.50	375
1924	Bran Biscuits, spiced and sweetened	4.80	3.81	1.22	7.63	7.60	2.20[3]	55.57	18.39	427
1924	Cellu Lemon Cookies	4.33	2.63	1.25	7.81	8.65	3.98[4]	45.12	27.48	475
	Health Food Co., New York City.									
1919	Alpha	9.48	5.76	10.97	68.56	0.35	1.01	6.40	8.44	380
1913	Alpha Best Diabetic Wafer	4.90	3.60	10.58	66.10	0.50	trace	11.30	13.60	432
1914	Alpha Best Diabetic Wafer	7.61	5.03	10.73	67.06	0.16	1.26	10.47	8.41	391
1919	Alpha No. 1 Best Diabetic Wafer, Casein	6.81	6.23	7.74	48.38	0.17	none	4.89	33.52	515
1919	Alpha No. 2 Best Diabetic Wafer	12.88	5.09	11.28	70.50	0.13	1.13	6.25	4.02	348
1906	Diabetic Biscuit	4.70	3.10	4.50	28.10	0.30	51.10[5]	13.70	9.00	413
1913	Diabetic Biscuit	8.90	2.50	4.00	25.00	0.20	46.50	7.70	9.20	400
1914	Diabetic Biscuit	5.80	2.55	5.75	35.94	0.35	39.77	6.76	8.83	409
1919	Gluten Cracker Dust	8.58	2.42	7.81	44.52	0.71	23.18	11.83	8.76	398
1913	Gluten Nuggets	5.70	2.80	4.83	27.50	0.20	38.60	12.40	12.80	429
1914	Gluten Nuggets	5.32	2.75	5.07	28.90	0.27	34.93	13.53	14.30	438
1919	Gluten Nuggets	8.59	2.35	5.06	28.84	0.33	32.18	15.38	12.33	417
1906	Glutona	4.80	2.50	3.38	19.30	0.30	54.90[5]	6.40	11.80	429
1919	Glutona Bread Sticks	8.21	2.29	5.86	33.40	0.29	30.60	14.10	11.11	412

[1] Includes fiber.
[2] Includes 0.92 per cent water-soluble carbohydrates.
[3] Includes 0.68 per cent water-soluble carbohydrates.
[4] Includes 2.04 per cent water-soluble carbohydrates.
[5] Includes water-soluble carbohydrates.

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber): Starch	Carbohydrate (other than fiber): Undetermined carbohydrate	Fat	Calories per 100 gms.
	Hard Breads and Bakery Products—Cont.									
	Health Food Co., New York City—Concluded.	%	%	%	%	%	%	%	%	
1906	Glutosac Butter Wafers	4.70	3.80	4.42	25.20	1.60	41.20[1]	10.60	12.90	424
1914	Glutosac Butter Wafers	5.44	2.10	4.98	28.39	0.38	38.93	10.82	13.94	438
1919	Glutosac Butter Wafers	10.30	1.89	5.46	31.12	0.36	40.42	7.92	7.99	390
1906	Glutosac Rusks	4.50	2.70	5.84	33.30	0.90	42.50[1]	12.30	3.80	387
1914	Glutosac Rusks	6.66	2.50	6.29	35.85	1.13	33.64	16.78	3.44	376
1919	Glutosac Rusks	9.91	2.20	6.08	34.65	0.83	34.26	12.53	5.62	376
1906	Glutosac Wafers, Plain	6.10	3.50	4.70	26.80	1.50	41.60[1]	10.90	9.60	404
1914	Glutosac Wafers, Plain	7.24	2.55	6.82	38.87	1.58	29.55	18.47	1.74	363
1919	Glutosac Wafers, Plain	10.47	2.55	7.20	41.04	1.19	25.12	12.09	7.54	342
1906	Glutosac Zwieback	7.60	2.50	5.20	29.60	1.20	40.90[1]	11.30	6.90	389
1914	Glutosac Zwieback	5.92	2.50	5.82	33.17	0.85	32.46	17.39	7.71	401
1919	Glutosac Zwieback	9.18	2.04	5.06	28.84	0.83	33.34	15.24	10.53	405
1906	No. 1 Proto Puffs	8.60	1.30	12.14	69.20	0.10	9.90[1]	9.90	1.00	365
1913	No. 1 Proto Puffs	7.20	2.70	12.21	69.60	0.20	4.30	13.10	2.90	374
1914	No. 1 Proto Puffs	8.71	2.80	11.56	65.89	0.40	9.23	10.15	2.82	366
1919	No. 1 Proto Puffs	9.32	2.73	12.12	69.08	0.20	3.26	10.74	4.67	371
1911	No. 2 Proto Puffs	8.20	1.80	8.38	47.80	0.20	27.20	13.30	1.50	367
1913	No. 2 Proto Puffs	7.90	2.50	9.06	51.60	0.20	19.00	16.70	2.10	368
1914	No. 2 Proto Puffs	9.16	2.60	9.40	53.58	0.40	20.70	11.47	2.09	362
1906	Protosac Rusk	5.90	2.00	6.54	37.30	0.50	43.90[1]	8.40	2.00	376
1914	Protosac Rusk	7.21	2.93	6.35	36.19	0.48	35.89	14.30	3.00	373
1919	Protosac Rusk	11.00	2.22	5.74	32.71	1.95	39.26	7.84	5.02	364
1913	Protosoy Diabetic Wafer	3.90	5.00	6.90	43.10	1.90	4.70	16.50	24.90	481
1914	Protosoy Diabetic Wafer	4.76	3.50	5.93	37.07	1.80	14.40	14.94	23.53	477
1919	Protosoy Diabetic Wafer	7.35	4.03	7.44	46.50	1.80	10.58	14.23	15.51	421

1906	Salvia Almond Sticks	6.60	7.50	6.27	39.20	1.90	18.70[1]	5.30	20.80	440
1914	Salvia Almond Sticks	2.63	3.38	3.57	22.31	0.70	28.29	12.75	29.94	523
1919	Salvia Almond Sticks	7.11	3.28	5.14	32.13	0.85	21.40	9.10	26.13	486
	Heintz Food Co., Chicago, Ill.									
1912	Gluten Biscuits	....	....	2.10	11.97	....	....	....	....	...
1913	Gluten Biscuits	6.40	3.50	2.05	11.70	1.30	21.40	37.40	18.30	447
1913	Glutin Biscuits	7.30	3.00	2.32	13.20	1.00	45.50	22.80	7.20	391
	Ch. Heudebert, Paris.									
1914	Pain d'Aleurone pour Diabétiques, "5% carbohydrates"	8.18	4.43	12.17	69.21	0.71	4.22	11.80	1.45	354
1914	Pain "Essentiel" en Biscottes	7.67	2.33	4.22	26.38	0.20	49.89	12.33	1.20	365
1914	*Pain de Gluten pour Diabétiques*	7.85	3.96	12.90	73.53	0.16	3.38	10.28	0.84	356
	R. Hundhausen, Hamm.									
1892	Aleuronatzwieback, high gluten	8.50	2.60	10.59	60.40	....	23.50[2]		5.00	381
1892	Aleuronatzwieback, low gluten	6.50	1.60	3.66	20.90	0.80	61.60		8.60	407
1894	Aleuronat-Biskuits	6.60	4.70	3.97	22.60	0.50	54.40		11.20	409
1891	Aleuronat-Kakes	3.40	1.10	3.22	18.40	1.20	66.50		9.40	424
	Huntley & Palmer, London.									
1912	Akoll Biscuits	9.30	3.90	8.51	53.20	0.40	trace	6.30	26.90	480
1913	Akoll Biscuits	7.20	3.40	8.72	54.50	0.70	trace	6.80	27.40	492
1916	Akoll Biscuits	7.97	3.43	8.57	53.56	0.49	trace	6.22	28.33	493
	Hygienic Food Co., New York City, Dist'b's. (Laboratoire E. Storage, Marseilles, France.)									
1924	Madeleines Lucullus	5.20	1.13	1.40	8.75	0.38	46.90[3]	14.21	23.43	490
1924	Vichy Gaufrettes	3.35	2.37	2.36	14.75	2.33	13.38[4]	12.89	50.93	622
1924	Gaufrettes Vanilles	7.63	0.80	1.40	8.75	0.30	81.30		1.22	371
1924	Nougatines de Vichy	2.15	2.23	1.60	10.00	1.20	41.00[5]	15.07	28.35	519

[1] *Includes water-soluble carbohydrates.*
[2] Includes fiber.
[3] *Includes 15.32 per cent water-soluble carbohydrates.*
[4] Includes 5.84 per cent water-soluble carbohydrates.
[5] *Includes 37.40 per cent water-soluble carbohydrates.*

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber): Starch	Carbohydrate (other than fiber): Undetermined carbohydrate	Fat	Calories per 100 gms.
	Hard Breads and Bakery Products—Cont.									
	Jacob & Co., Ltd., Dublin, Ireland.	%	%	%	%	%	%	%	%	
1923	Plasmon Oat Biscuit	5.86	2.43	2.46	15.38	0.26	49.25[1]	6.09	20.73	469
1923	Plasmon Plain Biscuit	6.40	2.54	2.98	18.63	0.19	52.53[2]	3.89	15.82	443
1923	Plasmon Sweet Biscuit	6.19	2.42	2.85	17.81	0.18	53.58[3]	4.64	15.18	441
1923	Plasmon Wholemeal Biscuit	5.88	2.85	3.20	20.00	0.71	47.19[4]	6.57	16.80	446
	Jireh Diabetic Food Co., New York City.									
1906	Diabetic Biscuits	6.30	2.00	2.37	14.80	0.90	65.40[5]	6.90	3.70	382
1906	Diabetic Biscuits	8.90	2.30	2.10	13.10	1.20	70.60		3.90	370
1913	Diabetic Biscuits	5.40	2.00	2.11	13.20	1.20	49.60	21.20	7.40	403
1906	Diabetic Rusks	8.70	3.10	2.34	14.60	0.90	67.70		5.00	374
1913	Diabetic Rusks	5.40	1.90	2.38	14.90	1.10	47.00	21.00	8.70	410
1906	Wheat Nuts	7.60	2.30	3.04	19.00	1.00	50.10[5]	4.40	15.60	434
1906	Wheat Nuts	6.00	3.20	3.36	21.00	1.20	46.30		22.30	470
	Johnson Educator Food Co., Boston, Mass.									
1906	Almond Biscuits	5.30	2.10	4.64	29.00	0.50	50.00[5]	4.30	8.80	412
1906	Diabetic Biscuits	5.90	1.90	4.05	25.30	0.40	54.90[5]	4.10	7.50	405
1906	Educator Crackers, Greseni Gluten	6.20	2.90	3.68	21.00	0.20	57.90[5]	7.20	4.60	386
1913	Educator Gluten Bread Sticks	8.40	2.40	5.74	32.70	0.30	37.50	11.50	7.20	392
1911	Gluten Cookies	4.80	2.70	4.22	24.10	0.30	37.80	14.30	16.00	449
1919	Gluten Cookies	5.94	3.16	5.08	28.96	0.40	36.49	13.45	11.60	422
1906	Gluten Rusk, Greseni Gluten	6.20	3.00	3.54	20.20	0.30	63.30[5]	6.70	0.30	364
1906	Gluten Wafers	6.90	0.90	4.85	27.60	0.30	57.00[5]	6.90	0.40	370
1906	Glutine, Greseni Gluten	6.40	2.60	3.50	20.00	0.40	63.10[5]	6.50	0.80	366
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	...	75.20[6]		0.90	359

	The Kellogg Food Co., Battle Creek, Mich.									
1912	Avena-Gluten Biscuit	7.90	2.10	3.42	19.50	0.40	41.10	16.30	12.70	422
1906	Potato Gluten Biscuit	8.20	0.80	12.80	73.00	0.00	9.80[5]	7.80	0.40	366
1909	Potato Gluten Biscuit	7.60	0.90	12.10	69.00	....	19.00[6]		2.60	379
1913	Potato Gluten Biscuit	8.80	0.80	6.64	37.90	0.40	39.50	12.10	0.50	363
1906	Pure Gluten Biscuit	7.50	1.00	12.85	73.20	0.20	9.10[5]	8.20	0.80	369
1909	Pure Gluten Biscuit	8.20	1.10	7.73	44.10	....	43.30[6]		3.30	379
1916	Pure Gluten Biscuit	8.30	2.04	12.96	73.87	0.12	4.02	10.82	0.83	362
1919	Pure Gluten Biscuit	8.33	2.04	13.75	78.38	0.35	2.87	6.53	1.50	365
1913	Taro-Gluten Biscuits	9.40	0.70	5.01	28.60	0.40	48.20	12.20	0.50	361
1906	40% Gluten Biscuit	7.50	1.60	5.73	32.70	0.10	52.60[5]	4.50	1.00	368
1909	40% Gluten Biscuit	7.50	1.40	5.82	33.20	....	55.10[6]		2.80	378
1911	40% Gluten Biscuit	8.00	1.60	6.93	40.40	0.20	35.30	13.30	1.20	367
1912	40% Gluten Biscuit	10.20	0.50	7.60	43.30	0.20	35.00	10.30	0.50	359
1913	40% Gluten Biscuit	7.20	1.30	5.95	31.90	0.30	45.00	13.50	0.80	369
1916	40% Gluten Biscuit	8.50	1.48	7.22	41.15	0.08	36.98	10.83	0.98	365
1919	40% Gluten Biscuit	9.55	1.24	7.18	40.92	0.23	35.35	10.89	1.62	364
1912	80% Gluten Biscuit	10.10	2.10	13.18	75.10	0.10	4.70	7.00	0.90	355
	Kirche, Düsseldorf.									
1895	Aleuronat-Kakes	5.00	0.90	2.72	15.50	1.60	63.30		13.70	439
	Klopfer Chemische Fabrik, Dresden.									
1910	Glidinebrot	12.70	2.30	7.62	43.40	0.30	32.80	6.30	2.20	350
	Laporte & Gauthier, Somerset, Manitoba.									
1921	Croustils, Dechloridized	7.55	1.25	2.66	16.63	0.44	64.75[7]	3.32	6.06	393
1921	Croustils, Simple	7.62	1.67	2.74	17.13	0.38	66.04[8]	3.75	3.41	378
1921	Croustils, Glutenized	7.88	1.50	4.84	30.25	0.46	49.91[9]	3.29	6.71	394
	Eugene Loeb, New York City.									
1913	Gluten Luft Bread	7.30	1.00	4.46	25.40	0.40	44.10	12.60	9.20	411

[1] Includes 11.34 per cent water-soluble carbohydrates.
[2] Includes 6.54 per cent water-soluble carbohydrates.
[3] Includes 9.70 per cent water-soluble carbohydrates.
[4] Includes 7.98 per cent water-soluble carbohydrates.
[5] Includes water-soluble carbohydrates.
[6] Includes fiber.
[7] Includes 10.30 per cent water-soluble carbohydrates.
[8] Includes 5.68 per cent water-soluble carbohydrates.
[9] Includes 5.36 per cent water-soluble carbohydrates.

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Undetermined carbohydrate	Fat	Calories per 100 gms.
	Hard Breads and Bakery Products—Cont.									
	Loeb's Diabetic Food Bakery, New York City.	%	%	%	%	%	%	%	%	
1913	Aerated Bread	5.53	1.60	8.73	49.76	0.34	23.59[1]	7.00	12.18	431
1919	Aerated Gluten Bread	9.17	1.78	8.04	47.83	0.18	26.78	3.18	11.08	411
1914	Diabetic Almond Macaroons	3.22	2.98	7.44	46.50	1.53	0.64	7.36	37.77	558
1916	Diabetic Almond Macaroons	4.55	4.01	5.48	34.25	1.72	trace	10.46	45.01	584
1919	Diabetic Almond Macaroons	5.90	4.39	4.86	30.38	1.93	0.59	10.48	46.33	713
1914	Diabetic Bread Sticks	8.72	2.28	8.07	50.44	0.60	24.64	9.88	3.44	371
1916	Diabetic Bread Sticks	8.15	2.87	7.41	46.31	0.19	35.02	7.17	0.29	339
1919	Diabetic Bread Sticks	9.14	2.67	6.69	41.81	0.20	35.44	6.93	3.81	331
1919	Diabetic Bread Sticks	7.99	3.87	6.72	42.00	0.15	35.23	10.32	0.44	314
1919	Diabetic Bread Sticks, Almond	7.93	2.00	6.30	39.38	0.70	31.22	7.08	11.69	416
1916	Diabetic Butter Cookies	6.14	2.22	6.29	39.31	0.15	32.18	5.07	14.93	471
1916	Diabetic Butter Cookies	4.07	2.86	5.02	31.38	0.35	30.66	8.39	22.29	482
1919	Diabetic Butter Cookies	8.85	3.06	5.84	36.50	0.13	31.05	8.38	12.03	412
1914	Diabetic Lady Fingers	6.01	2.75	9.05	56.56	0.35	1.81	4.23	28.29	505
1916	Diabetic Lady Fingers	5.97	3.46	7.68	48.00	0.07	2.14	7.57	32.79	527
1919	Diabetic Lady Fingers	8.33	4.41	7.64	47.75	0.05	1.91	3.50	34.05	519
1914	Diabetic Sponge Cookies	6.92	2.75	8.75	54.69	0.55	1.24	3.74	30.11	510
1916	Diabetic Sponge Cookies	5.82	3.49	7.14	44.63	0.23	1.91	6.75	37.17	548
1919	Diabetic Sponge Cookies	8.66	4.45	7.95	49.69	0.11	1.91	1.41	33.77	516
1919	Gluten Bread	7.85	1.80	7.46	42.52	0.22	27.71	8.76	11.14	416
1914	Gluten Luft Bread	5.68	2.05	8.38	47.77	0.63	22.89	7.74	13.24	433
1916	Gluten Luft Bread	7.05	1.20	7.12	40.58	0.18	29.93	11.28	9.78	415
1916	Gluten Zwieback	8.27	2.34	7.27	41.44	0.20	35.72	9.64	2.39	369
1915	Gluten Zwieback	8.39	1.45	7.47	42.58	0.18	23.43	10.52	13.45	427
1919	Gluten Zwieback	9.61	1.91	6.78	38.65	0.14	36.06	10.64	2.99	368

	Loeb's Diabetic Food Bakery, New York City—Concluded.									
1915	Gluten Almond Zwieback	7.84	2.38	6.81	42.56	0.60	19.13	6.90	20.59	460
1916	Gluten Almond Zwieback	8.04	1.97	7.04	44.00	0.33	33.10	6.46	6.10	389
1919	Gluten Almond Zwieback	8.91	1.94	6.60	41.25	0.58	32.57	6.97	7.78	392
	Gustav Müller & Co., Agent, New York City.									
1913	Charasse Biscuits Croquettes au Gluten	7.30	0.50	5.49	31.30	0.20	30.60	14.70	5.40	395
1913	Charasse Biscottes Lucullus	7.50	1.80	1.82	11.40	0.20	59.20	14.20	5.70	391
1913	Charasse Gluten Exquis Biscuits aux Amandes	5.30	1.60	2.90	16.50	0.60	25.50	26.70	23.80	489
1913	Charasse Gluten Fleur de Neige Pain	6.10	2.30	5.74	32.70	0.40	25.10	20.90	12.50	427
1913	Charasse Mignonettes au Gluten	8.20	2.10	6.42	36.60	0.30	27.30	19.80	5.70	386
1913	Charasse Pain de Gluten	8.10	2.10	6.53	37.20	0.20	27.20	19.90	5.30	385
1913	Charasse Tranches Grilles pour Potage	7.70	2.30	6.50	40.60	0.30	28.80	16.70	3.60	377
	Nasmith's Ltd., Toronto.									
1916	Diabetic Bread	8.15	1.75	1.82	11.38	....	63.71	13.77	1.24	331
	Nutrivoid Diabetic Flour Co., Brooklyn, N. Y.									
1925	Nutrivoid Bran Wafers	4.98	6.33	0.92	5.75	8.68	4.20[2]	38.98	31.08	...
	Pure Gluten Food Co., New York City.									
1914	No. 1 Dainty Fluffs	7.04	0.75	12.79	79.94	0.45	10.74	0.54	0.54	370
1914	No. 2 Dainty Fluffs	7.45	0.68	10.60	66.25	0.28	21.85	3.02	0.47	369
1916	Dainty Fluffs	7.15	1.25	12.81	80.04	0.12	7.65	2.97	0.82	370
1913	Gum Gluten Biscuit Crisps	5.30	1.70	6.86	39.10	0.90	39.30	13.00	0.70	372
1914	Gum Gluten Biscuit Crisps	5.97	1.70	8.43	48.05	1.08	31.22	11.46	0.52	368
	Rademann's Nährmittelfabrik, Frankfurt.									
1893	Diabetiker-Biscuits	2.90	3.50	7.06	44.10	....	10.00	9.70	29.80	523
1913	Diabetiker-Biscuits	5.00	1.10	4.74	29.60	0.20	25.90	18.60	19.60	473
1913	Diabetiker-Bretzel	6.80	3.00	5.02	31.40	0.20	40.70	9.40	8.50	402
1910	Diabetiker-Cakes	....	....	2.02	12.60	....	39.80		....	...
1913	Diabetiker-Cakes	6.50	3.00	4.74	29.60	0.20	39.10	8.10	13.50	429
1893	Diabetiker-Chokolade-Biskuits	1.80	3.80	7.18	44.90	....	11.80	10.10	27.60	516
1913	Diabetiker-Dessert-Gebäck	4.30	2.50	3.55	22.20	1.10	5.90	21.60	42.40	580

[1] Includes 2.83 per cent water-soluble carbohydrates.

[2] All water-soluble carbohydrates.

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Undetermined carbohydrate	Fat	Calories per 100 gms.
	Hard Breads and Bakery Products—Cont.									
	Rademann's Nährmittelfabrik, Frankfurt—Concl.	%	%	%	%	%	%	%	%	
1910	Diabetiker-Makronen	....	....	1.97	12.30	....	11.30		....	...
1910	Diabetiker-Makronen	4.50	3.20	3.57	22.30	1.10	8.80	12.10	48.00	605
1913	Diabetiker-Makronen	4.00	3.00	3.71	23.20	1.20	3.00	17.60	48.00	607
1910	Diabetiker-Stangen	....	....	3.63	22.70	....	17.00		....	...
1910	Diabetiker-Stangen	10.50	2.10	4.77	29.80	....	24.60[1]		33.00	515
1913	Diabetiker-Stangen	4.50	3.60	2.83	17.70	0.50	21.40	8.10	44.20	586
1910	Diabetiker-Zwieback	....	....	2.62	16.40	....	37.60		....	...
1910	Diabetiker-Zwieback	9.40	2.20	4.03	25.20	....	47.00	4.30[1]	11.90	413
1893	Erdnuss-Biskuits	1.90	2.70	5.57	34.80	....	9.00	30.10	21.50	489
1910	Käsestangen	6.90	2.20	1.79	11.20	....	50.49[1]		29.30	511
1913	Käsastangen	6.70	3.80	1.49	9.30	0.10	38.00	8.40	33.70	524
1910	Sanitätszwieback	....	....	2.80	17.50	....	58.40		....	...
	Schelle, Braunschweig.									
1897	Aleuronat-Kakes	4.90	1.30	3.18	18.10	....	64.90[1]		10.80	429
	R. M. Scott, Ipswich, England.									
1923	Gluten and Almond Biscuits	5.93	2.24	3.80	23.75	0.50	44.49[2]	3.18	19.91	465
	Seidl, München.									
1910	Kleberzwieback	6.30	....	2.37	13.50	....	67.90		7.80	396
	La Societe L'Aliment "Essential," Nanterre, France.									
1921	Cacao and Oat Cakes	6.90	2.81	2.25	14.06	1.98	44.26[3]	17.72	12.27	475
1921	Heudebert, Aleurone Bread	7.00	2.81	12.07	68.80	0.21	6.66[4]	8.23	6.19	390
1921	Heudebert, Aleurone Bread	9.82	3.19	10.39	59.22	0.76	16.28[5]	6.73	4.00	365

1921	Heudebert, Bread of Gluten	10.11	2.71	10.78	61.45	0.51	11.20[6]	8.04	5.98	377
1921	Heudebert, Bread of Gluten	6.83	2.62	10.82	61.67	0.31	14.69[7]	7.03	6.85	395
1921	Heudebert, Bread of Gluten	6.33	2.66	10.94	62.36	0.32	15.25[8]	7.40	5.68	391
1921	Heudebert, Rolls with Gluten	7.51	2.32	1.70	9.69	0.43	66.10[9]	5.20	8.75	403
1921	Heudebert, Rusks of Gluten	6.56	1.62	1.90	10.84	0.44	67.35[10]	5.56	7.63	404
1921	Heudebert, Special Diabetic Bread	7.01	2.91	10.48	59.74	0.57	17.64[11]	5.38	6.75	392
1921	Heudebert, Special Diabetic Bread	11.19	3.04	9.01	51.36	0.41	21.12[12]	7.79	5.09	367
1921	"Regimette" Dessert Cake	3.68	1.27	1.10	6.88	0.37	67.90[13]	8.35	11.55	436
	James Strachen.									
1916	Gluten Bread	6.20	2.20	2.96	16.87	0.10	52.74	21.29	0.60	369
	Therapeutic Food Co., Inc., New York and London.									
1924	Aleurone Bread	9.89	3.16	10.88	62.02	0.27	15.42[14]	7.54	1.67	355
1924	Bread of Gluten	9.03	3.80	12.56	71.59	0.07	6.29[15]	7.73	1.49	356
1924	Brusson Jeune Gluten Bread	10.01	0.72	6.89	39.27	0.14	12.83[16]	36.04	0.99	361
1923	Dr. Charrasse Gluten Bread	7.83	2.25	7.49	42.69	0.16	35.99[17]	5.25	5.83	388
1923	Dr. Charrasse Gluto-Kola Bread	8.51	2.17	7.34	45.88	0.16	37.26[18]	0.00	6.02	387
1923	Dr. Charrasse Gluto-Soja Bread	8.11	2.20	7.77	48.56	0.26	33.30[19]	0.69	6.88	392
1923	Dr. Charrasse Supreme Bread	8.21	2.45	7.30	45.63	0.22	35.93[20]	0.64	6.92	370
1923	Energen New Natural Gluten Bread	7.05	0.97	5.80	33.06	0.59	44.04[21]	4.23	10.06	416
1925	Gluten Bread	5.67	4.59	12.81	73.02	0.26	5.93[22]	6.85	3.68	376
1924	Special Diabetic Bread	9.44	2.86	11.06	63.04	0.14	15.01[23]	8.43	1.08	356
	Roman Uhl, Carlsbad.									
1913	Carlsbad-Water Biscuits, "Sprudel" Brand	8.10	1.70	1.60	10.00	0.20	55.60	19.20	5.20	386
	G. Van Abbott & Sons, London.									
1913	Caraway Biscuits for Diabetics	6.70	3.60	5.70	35.60	0.70	8.60	7.30	37.50	544
1913	Diabetic Rusks for Diabetics	10.80	1.20	11.34	70.90	0.30	12.60	3.40	0.80	355

[1] Includes fiber.
[2] Includes 3.76 per cent water-soluble carbohydrates.
[3] Includes 7.23 per cent water-soluble carbohydrates.
[4] Includes 0.15 per cent water-soluble carbohydrates.
[5] Includes 2.72 per cent water-soluble carbohydrates.
[6] Includes 1.24 per cent water-soluble carbohydrates.
[7] Includes 1.10 per cent water-soluble carbohydrates.
[8] Includes 0.93 per cent water-soluble carbohydrates.
[9] Includes 6.98 per cent water-soluble carbohydrates.
[10] Includes 9.30 per cent water-soluble carbohydrates.
[11] Includes 1.52 per cent water-soluble carbohydrates.
[12] Includes 2.36 per cent water-soluble carbohydrates.
[13] Includes 20.90 per cent water-soluble carbohydrates.
[14] Includes 2.03 per cent water-soluble carbohydrates.
[15] Includes 0.40 per cent water-soluble carbohydrates.
[16] Includes 3.83 per cent water-soluble carbohydrates.
[17] Includes 3.73 per cent water-soluble carbohydrates.
[18] Includes 4.50 per cent water-soluble carbohydrates.
[19] Includes 3.26 per ceot water-soluble carbohydrates.
[20] Includes 3.33 per cent water-soluble carbohydrates.
[21] Includes 8.60 per cent water-soluble carbohydrates.
[22] Includes 1.26 per cent water-soluble carbohydrates.
[23] Includes 0.96 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Carbohydrate (other than fiber) Undetermined carbohydrate	Fat	Calories per 100 gms.
	Hard Breads and Bakery Products—Concl.									
	G. Van Abbott & Sons, London—Concluded.	%	%	%	%	%	%	%	%	
1913	Euthenia Biscuits	5.50	3.40	5.73	35.80	1.40	6.90	6.30	40.70	562
1913	Gluten Biscottes or Rolls	10.50	2.40	8.26	47.10	0.20	29.80	7.70	2.30	359
1913	Gluten Bread or Slices	10.60	2.00	8.66	49.40	0.20	27.40	8.20	2.20	361
1913	Gluten Butter Biscuits for Diabetics	6.10	3.00	7.06	40.20	0.90	9.00	7.60	33.20	526
1913	Ginger Biscuits for Diabetics	4.10	3.40	5.54	34.60	1.80	10.90	5.80	39.40	560
1913	Midolia Biscuits	6.00	4.30	2.82	17.60	4.10	13.40	18.20	36.40	524
1913	Walnut Biscuits for Diabetics	4.40	2.90	3.34	20.90	2.30	trace	12.30	57.20	648
1923	Soya Biscuits	4.85	5.52	6.27	39.19	2.20	11.44[1]	11.82	24.98	475
	Waukesha Health Products Co., Waukesha, Wis.									
1919	Hepco Dodgers	8.73	5.68	6.79	42.44	3.85	1.01	21.56	16.73	411
	Weston's Bakery, Boston, Mass.									
1915	Gluten Cookies	....	....	4.86	27.70	....	19.59	....	....	...
	Woman's Baking Co., Boston, Mass.									
1921	Bran Cookies, Anice	16.12	....	1.18	7.39	....	5.19[2]	....	25.87[3]	...
1921	Bran Cookies, Caraway	15.29	....	1.30	8.13	....	3.48[2]	....	23.36[3]	...
1920	Bran Cookies, Caraway	12.24	6.90	1.30	8.13	2.62	6.49[2]	38.61	25.01[3]	...
1921	Bran Cookies, Cocoa Nib	13.41	....	1.30	8.13	....	6.14[2]	....	27.80[3]	...
1920	Bran Cookies, Cocoa Nib	14.87	6.30	1.33	8.33	6.05	11.24[2]	29.17	24.04[3]	...
1921	Bran Cookies, Spice	15.04	....	0.98	6.11	....	6.32[2]	....	26.75[3]	...
1920	Bran Cookies, Spice	16.31	6.43	1.12	6.99	6.90	12.21[2]	32.48	18.68[3]	...
1921	Bran Muffins	28.41	....	1.33	8.33	....	4.76[2]	....	6.11[3]	...
1920	Bran Muffins	41.51	6.50	1.00	6.26	6.72	6.37[2]	27.03	5.61[3]	...

1920	Cellu Biscuit	32.81	6.33	0.53	3.34	14.26	3.01[2]	25.65[4]	14.60[3]	...
1920	Cellu Cookies, Caraway	14.16	5.48	0.89	5.58	16.53	3.84[2]	31.95[4]	22.46[3]	...
1921	Cellu Cookies, Lemon	12.28	....	0.65	4.10	....	3.12[2]	....	27.35[3]	...
1920	Cellu Cookies, Lemon	12.94	5.22	0.69	4.32	17.43	4.62[2]	34.10[4]	21.37[3]	...
1921	Cellu Cookies, Vanilla	14.13	....	0.66	4.11	....	4.39[2]	....	23.35[3]	...
1920	Cellu Cookies, Vanilla	17.16	5.69	9.71	4.45	16.98	3.80[2]	32.61[4]	19.31[3]	...
1920	Cellu Kisses	17.85	4.09	3.68	23.00	27.12	2.49[2]	25.22[4]	0.23[3]	...
1921	Cellu Muffins	23.62	....	0.61	3.84	....	3.38[2]	....	14.33[3]	...
1920	Cellu Muffins	29.08	5.71	0.59	3.66	18.23	3.71[2]	27.02[4]	12.93[3]	...
1920	Cellu Nuts	15.91	5.71	0.86	5.38	16.80	3.64[2]	23.82[4]	28.74[3]	...
1921	Cellu Soup Wafers	15.96	....	0.53	3.32	....	4.25[2]	....	27.66[3]	...
1920	Cellu Soup Wafers	14.22	6.66	0.64	4.01	14.97	4.12[2]	31.39[4]	24.63[3]	...
	Miscellaneous.									
1921	Passover Bread	7.04	0.60	2.38	14.88	0.38	70.46	6.64	0.37	371
	Breakfast Foods.									
	Arnaud, Inc., New York City.									
1921	Starchless Breakfast Food	10.39	2.06	0.32	2.00	4.16	70.85[5]	10.32	0.21	335
	Brusson Jeune, Villemur, France.									
1913	Farine au Gluten	10.90	0.60	5.42	30.90	0.20	48.80	8.00	0.60	356
1910	Gluten Semolina	9.70	0.70	2.75	15.70	0.30	64.90	8.20	0.50	360
	Curdolac Food Co., Waukesha, Wis.									
1924	Krinkles	8.52	4.40	1.73	10.81	11.53	4.77[6]	45.53	14.44	374
	Dieto Food Co., New York City.									
1914	Dieto Nut Cereal	5.00	1.95	3.46	21.63	1.22	39.54	12.28	18.38	459
1914	Wheat and Barley Cereal	6.77	1.68	1.86	11.63	2.00	61.42	14.35	2.15	359
	Efficiency Products Co., Somerville, N. J.									
1926	Ecmo Breakfast Food	10.81	1.89	1.02	6.38	8.16	2.56[7]	69.12[4]	1.08	...
1924	Nut Flakes	9.56	1.04	0.70	4.38	5.61	2.78[7]	75.59[4]	1.04	...

[1] Includes 8.94 per cent water-soluble carbohydrates.
[2] Includes water-soluble carbohydrates.
[3] Largely mineral oil.
[4] Largely unassimilable.
[5] Includes 6.72 per cent water-soluble carbohydrates.
[6] Includes 3.90 per cent water-soluble carbohydrates.
[7] All water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber)		Fat	Calories per 100 gms.
							Starch	Undetermined carbohydrate		
	Breakfast Foods—Continued.									
	Farwell & Rhines, Watertown, N. Y.	%	%	%	%	%	%	%	%	
1913	Barley Crystals	9.90	1.20	1.84	11.50	0.90	62.70	12.50	1.30	359
1913	Cresco Grits	11.10	0.60	2.85	17.80	0.50	54.10	14.50	1.40	358
	William Hazard Co., New York City.									
1908	Hazard's Wheat Protein Breakfast Food	8.50	0.70	6.42	36.60	....	53.20[1]		1.00	368
	Health Food Co., New York City.									
1913	Manana	10.20	2.40	6.02	37.60	1.10	31.00	15.80	1.90	355
1914	Manana Gluten Breakfast Food	7.56	2.53	6.82	38.87	1.73	29.87	17.45	1.99	363
1919	Manana Gluten Breakfast Food	8.49	2.47	7.86	44.80	1.09	21.99	12.47	8.69	396
1919	Protosoy (Cereal)	7.65	5.39	6.42	40.13	3.78	trace	24.88	18.17	424
	Jireh Diabetic Food Co., New York City.									
1913	Whole Wheat Farina	6.20	1.80	2.06	11.70	2.20	59.50	16.30	2.30	371
1913	Frumenty	6.20	1.40	1.97	12.30	1.10	65.40	11.90	1.70	374
	Kellogg Food Co., Battle Creek, Mich.									
1911	Granola	6.10	2.30	2.22	13.90	0.60	45.20	31.10	0.80	368
	Kellogg's Toasted Corn Flake Co., Battle Creek, Mich.									
1923	Kellogg's Bran Cooked and Krumbled	5.05	6.30	2.31	14.41	....	68.53[1]	....	3.40	362
	Kramer Surgical Stores, New York City.									
1926	Breakfast Cereal	5.64	4.02	5.25	32.81	5.76	3.54[2]	46.98	1.25	345

	Lister Bros., Inc., New York City.									
1924	Starch-free Bran	8.16	4.30	2.62	16.38	21.14	1.63[3]	44.37	4.02	286
1924	Starch-free Bran	5.65	5.72	2.80	17.50	18.88	5.73[4]	40.97	5.55	307
	Loeb's Diabetic Food Bakery, New York City.									
1919	Caseine Breakfast Cereal	4.52	4.61	5.86	36.63	....	0.70	11.02[1]	42.52	576
1919	Gluten Breakfast Cereal	4.38	2.73	5.12	29.18	1.04	25.51	17.78	19.38	464
	S. S. Pierce Co., Boston, Mass.									
1926	Deshell Starchless Agar Flakes	10.50	3.96	0.30	1.88	0.25	none	83.26[5]	0.15	...
	Plasmon, Ltd., London.									
1923	Plasmon Oats	9.02	1.80	2.77	17.31	0.53	57.39[6]	5.86	8.09	395
	Pure Gluten Food Co., New York City.									
1919	Gluten Breakfast Food	9.17	1.32	7.16	40.75	0.10	35.70	12.28	0.68	361
1904	Gum Gluten Breakfast Food	9.50	0.90	8.70	49.60	0.50	30.40	8.30	0.80	360
1906	Gum Gluten Breakfast Food	9.10	1.10	8.54	48.70	0.30	31.00[7]	8.20	1.60	366
1911	Gum Gluten Breakfast Food	7.50	1.20	6.05	34.40	0.40	37.90	17.30	1.30	370
1911	Gum Gluten Granules	7.50	1.50	7.28	41.50	0.30	32.30	15.30	1.60	371
1916	Gum Gluten Granules	6.95	0.80	6.90	39.33	0.08	40.50	11.42	0.92	363
1914	Hoyt's *Gum* Gluten Breakfast Food	6.48	0.60	7.26	41.38	0.28	39.21	11.19	0.86	375
1914	Hoyt's Gum Gluten Granules	6.64	0.73	6.83	38.93	0.45	41.93	10.63	0.69	372
1901	Pure Gluten Breakfast Cereal	9.30	0.70	6.99	39.80	0.30	48.30		1.60	367
1923	Hoyt's Gluten Flakes	8.18	3.55	7.84	44.69	3.89	16.48[8]	18.86	4.35	359
1924	Hoyt's Gluten Flakes	....	....	7.52	42.86	....	....	....	....	...
1924	Hoyt's Gluten Flakes	5.94	3.78	7.77	44.29	5.93	12.83[9]	22.05	5.18	363
1924	Hoyt's Gluten Flakes	7.45	4.14	7.14	40.70	4.73	16.57[10]	24.18	2.23	346
1924	Hoyt's Special Gluten Flakes	8.64	1.01	13.00	74.10	0.31	5.91[11]	8.09	1.94	370
1924	Hoyt's *Protein* Cereal	5.95	0.98	13.93	79.40	0.38	2.85[12]	8.89	1.55	379

1 Includes fiber.
3 Includes 1.46 per cent water-soluble carbohydrates.
3 Includes 0.76 per cent water-soluble carbohydrates.
4 Includes 2.86 per cent water-soluble carbohydrates.
5 Largely unassimilable.
6 Includes 2.04 per cent water-soluble carbohydrates.
7 Includes water-soluble carbohydrates.
8 Includes 11.98 per cent water-soluble carbohydrates.
9 Includes 9.96 per cent water-soluble carbohydrates.
10 Includes 11.84 per cent water-soluble carbohydrates.
11 Includes 0.67 per cent water-soluble carbohydrates.
12 Includes 0.80 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Carbohydrate (other than fiber) Undetermined carbohydrate	Fat	Calories per 100 gms.
	Breakfast Foods—Concluded.									
	Pure Gluten Food Co., Columbus, Ohio.	%	%	%	%	%	%	%	%	
1919	Hoyt's Gluten Breakfast Food, 40% Protein ..	9.23	0.93	8.07	46.00	0.51	31.39	10.15	1.79	366
1919	Hoyt's Gluten Granules, over 40% Protein ...	9.75	0.97	7.68	43.78	0.68	32.15	10.08	2.59	327
	Gerda H. Wagner, Brooklyn, N. Y.									
1924	Diabetic Cereal	7.45	4.47	1.61	10.06	13.28	1.35[1]	58.82	4.57	322
	Waukesha Health Products Co., Waukesha, Wis.									
1919	Hepco Grits	8.88	5.51	6.44	40.25	4.19	0.87	23.91	16.39	408
	Macaroni, Noodles, etc.									
	Brusson Jeune, Villemur, France.									
1910	Pâtes aux Oeufs Macaroni	8.80	0.70	2.22	13.90	trace	69.20	7.00	0.40	364
1910	Pâtes aux Oeufs Nouillettes	8.70	0.70	2.30	14.40	trace	68.90	6.80	0.50	365
1913	Petites Pâtes au Gluten	9.00	0.80	2.98	17.00	0.20	61.20	10.80	1.00	365
1910	Vermicelle au Gluten	8.00	0.80	2.94	16.80	trace	65.80	8.20	0.40	367
	Callard & Co., London.									
1923	Casoid Flakes (Macaroni Paste)	9.63	7.41	12.56	78.50	0.22	1.16[2]	0.01	3.07	346
1923	Casoid Vermicelli	9.33	7.31	12.80	80.00	0.13	0.50[2]	0.00	2.73	347
	The Dieto Food Co., New York City.									
1914	Whole Wheat Brand Macaroni	9.81	0.90	2.22	13.88	0.57	58.72	14.98	1.14	361
	Jireh Diabetic Food Co., New York City.									
1913	Macaroni	8.80	1.10	2.70	16.90	0.90	58.80	12.60	0.90	361

1926	Macaroni	5.50	6.48	6.68	41.75	3.99	4.51[3]	32.93	4.84	360
1926	Broad Noodles	5.05	6.45	6.61	41.31	2.61	5.60[4]	33.84	5.14	369
1926	Fine Noodles	4.75	6.63	6.67	41.69	2.58	4.66[5]	34.56	5.13	370
	Eugene Loeb, New York City.									
1913	Home Made Noodles	9.80	1.00	6.69	41.80	0.20	36.70	5.00	5.50	384
	Loeb's Diabetic Food Bakery, New York City.									
1916	Gluten Noodles	9.25	0.69	7.23	41.21	0.15	33.19	14.48	1.03	365
1919	Gluten Noodles	10.23	1.63	6.54	37.28	0.15	36.84	10.28	3.59	370
	The Marvelli Co., Detroit, Mich.									
1901	Macaroni	13.40	0.50	3.31	20.70	....	64.80[6]		0.60	347
1912	Spaghetti	....	....	2.48	15.50	....	....	....	....	...
	Pure Gluten Food Co., New York City.									
1906	Gum Gluten Macaroni	10.30	0.70	6.62	37.70	0.30	46.20[2]	3.80	1.00	360
1911	Gum Gluten Noodles	8.30	1.10	5.86	33.40	0.20	42.00	12.60	2.40	374
1914	Hoyt's Gum Gluten Noodles	8.21	0.65	6.48	36.93	0.33	41.82	10.83	1.23	369
	Nuts and Nut Preparations.									
	Dieto Food Co., New York City.									
1914	Pine Nuts	2.23	4.55	6.35	39.69	0.75	none	2.76	50.02	620
	Chas. Lawrence Co., Boston, Mass. (sold by).									
1913	California Paper Shell Almonds, edible portion	3.50	3.50	2.94	18.40	3.00	none	16.30	55.30	637
	Christian National Food Co., Kenilworth, N. J.									
1916	Christian's Protoid Nuts	4.23	4.27	6.02	37.63	....	trace	5.65[6]	48.22	607
	Jireh Diabetic Food Co., New York City.									
1913	Diabetic Pine Nuts (Pignolias)	2.00	4.60	6.35	39.70	0.90	none	3.40	49.40	617

[1] All water-soluble carbohydrates.
[2] Includes water-soluble carbohydrates.
[3] Includes 2.48 per cent water-soluble carbohydrates.
[4] Includes 2.70 per cent water-soluble carbohydrates.
[5] Includes 2.66 per cent water-soluble carbohydrates.
[6] Includes fiber.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber): Starch	Carbohydrate (other than fiber): Undetermined carbohydrate	Fat	Calories per 100 gms.
	Nuts and Nut Preparations—Concluded.									
	The Kellogg Food Co., Battle Creek, Mich.	%	%	%	%	%	%	%	%	
1906	Almond Butter (Sanitas)	0.90	2.90	3.62	22.60	3.90	3.70[1]	4.50	61.50	677
1908	Almond Butter (Sanitas)	2.30	3.00	3.47	21.70	....		11.50[2]	61.50	686
1901	Malted Nuts	2.60	2.20	3.79	23.70	....		43.90[2]	27.60	519
1913	Nut Bromose (Meltose and Nuts)	14.00	1.50	2.73	17.10	1.20	3.20	36.20	26.80	467
1906	Nut Butter (Sanitas)	0.20	2.90	4.61	28.80	3.70	9.10[1]	4.80	50.50	625
1906	Nut Meal	3.00	2.20	4.64	29.00	2.00	8.90[1]	3.20	51.70	630
1906	Nuttolene	55.20	2.20	2.03	12.70	1.80		6.30	21.80	272
1913	Pine Nuts	2.60	4.50	6.08	38.00	1.10		4.20	49.60	615
1906	Protose	62.20	1.50	3.62	22.60	0.90		3.60	9.20	188
	Nashville Sanitarium-Food Co., Nashville, Tenn.									
1913	Malted Nut Food	3.40	1.70	3.95	24.70	....	3.40	24.10[2]	42.70	593
1913	Nut Butter	1.90	2.90	4.48	28.00	1.60	3.80	9.20	52.60	637
1913	Nutcysa	57.00	1.80	2.06	12.90	1.00	trace	6.30	21.00	266
1913	Nutfoda	62.30	1.60	3.33	20.80	0.50	trace	6.80	8.00	182
	Chocolate and Chocolate Preparations.									
	Brusson, Jeune, Villemur, France.									
1913	Chocolate with Added Gluten à la Vanille	2.60	3.20	2.54	15.90	2.20	9.20	17.20	49.70	617
	Callard, Stewart & Watt, London.									
1913	Casoid Chocolate Almonds	3.50	3.10	3.57	22.30	3.20	trace	16.10	51.80	620
	Callard & Co., London.									
1923	Casoid Chocolates	5.54	3.14	3.67	22.94	1.54	5.01[1]	23.02	38.81	553
1925	Casoid Chocolate Creams	11.80	2.77	3.48	21.75	1.58	4.75[1]	35.80	21.55	443
1925	Casoid Chocolate Peppermints	12.98	2.66	3.57	22.31	1.48	4.06[1]	36.03	20.48	434

1925	Casoid Chocolate Truffles	5.90	3.43	4.44	27.75	1.78	5.19	9.25	40.70	589
1923	Casoid Dessert Chocolate	3.83	3.95	3.98	24.88	2.13	7.87[1]	11.26	46.08	591
1925	Casoid Marzipan Chocolate	7.50	3.44	3.96	24.75	1.70	4.19[1]	21.24	37.18	535
1923	Casoid Nut Chocolate	3.66	3.88	3.82	23.88	2.22	8.64[1]	11.28	46.44	593
1923	Sugarless Chocolate	2.81	4.28	2.24	14.00	3.16	13.99[1]	17.33	44.34	580
	Fritz, Vienna.									
1924	Plain Chocolate Bars and Cakes	3.22	2.90	2.41	15.06	1.77	6.97[3]	15.28	54.80	642
1924	Nut Chocolate	3.39	2.96	3.07	19.19	2.17	4.90[4]	12.99	54.40	638
1924	Ferment-Schokolade	1.08	1.21	1.00	6.25	0.83	26.74[5]	15.11	48.78	631
1924	Saccharin Schokolade	3.46	3.42	2.77	17.31	2.45	12.70[6]	17.98	42.68	576
1924	Dr. Fromm's Conglutin Schokolade	3.87	7.11	2.91	18.19	0.93	19.41[7]	13.81	36.68	536
1924	Cakes with Chocolate Icing	4.92	2.25	3.99	24.94	1.55	25.58[8]	9.49	31.27	521
	Fromm & Co., Dresden.									
1913	Conglutin-Diabetiker-Schokolade	4.00	5.40	2.82	17.60	1.20	4.30	28.40	39.10	553
	Karl Goldscheider, Carlsbad.									
1914	Feinste Dessert-Schokolade für Diabetiker, "9.98% carbohydrates"	2.17	1.80	1.82	11.38	1.68	4.98	20.44	57.55	665
1914	Feinste Mocca-Schokolade für Diabetiker, "10.26% carbohydrates"	2.20	2.25	1.63	10.19	1.65	4.11	19.38	60.22	677
1914	Feinste Nuss-Schokolade für Diabetiker, "11.32% carbohydrates"	3.37	2.65	2.34	14.63	1.70	6.86	16.44	54.35	641
1914	Feinste Orange-Schokolade für Diabetiker, "9.98% carbohydrates"	2.38	2.20	1.83	11.44	1.43	4.98	19.93	57.64	664
	Groetzsch, Frankfurt.									
1910	Esschokolade (Orange)	4.60	2.30	1.73	10.80	4.40	12.00	5.20	60.70	658
1910	Kochschokolade	10.90	6.70	4.05	25.30	5.90	15.90	20.20	25.10	432
	Hygienic Food Co., New York City. (Laboratoire E. Storage, Marseilles, France.)									
1924	Pastilles de Chocolat	4.50	4.75	3.36	21.00	1.20	30.70[1]	11.95	25.90	488
1924	Croquettes de Chocolat Sucre	4.88	4.90	3.53	22.06	1.28	29.88[1]	10.55	26.45	488

[1] Includes water-soluble carbohydrates.
[2] Includes fiber.
[3] Includes 2.36 per cent water-soluble carbohydrates.
[4] Includes 1.64 per cent water-soluble carbohydrates.
[5] Includes 23.76 per cent water-soluble carbohydrates.
[6] Includes 6.96 per cent water-soluble carbohydrates.
[7] Includes 15.58 per cent water-soluble carbohydrates.
[8] Includes 21.30 per cent water-soluble carbohydrates.

TABLE II. ANALYSES OF SPECIAL FOODS—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Carbohydrate (other than fiber) Undetermined carbohydrate	Fat	Calories per 100 gms.
	Chocolate and Chocolate Preparations—Concl.									
	Loeb's Diabetic Food Bakery, New York City.									
1914	Almond Chocolate Bars	2.88	3.77	2.60	16.25	4.32	5.74	26.04	41.00	561
1914	Diabetic Chocolates	1.98	3.85	2.38	14.88	4.90	6.92	16.05	51.42	614
1919	Almond Chocolate Bars	4.76	3.43	2.38	14.88	2.81	5.34	15.55	53.23	622
1919	Diabetic Chocolate	4.72	3.45	2.35	14.69	2.62	7.26	15.52	51.74	716
	Plasmon Co., London.									
1901	Plasmon Chocolate	....	....	3.38	21.10	....	....	....	....	...
1903	Plasmon Chocolate	3.50	2.50	3.23	20.20	0.70	trace	48.00	25.10	499
1923	Plasmon Chocolate	1.76	1.74	2.20	13.75	0.47	38.52[1]	14.40	29.36	531
	Rademann's Nährmittelfabrik, Frankfurt.									
1910	Diabetiker-Chokolade	....	....	2.58	16.10	....	9.60		....	...
1913	Diabetiker-Chokolade	2.50	3.20	2.80	17.50	2.30	3.80	13.10	57.60	656
	Troponwerke, Mülheim.									
1898	Tropon-Chokolade	1.70	1.60	2.91	18.20	2.70	49.90		25.90	506
1899	Tropon-Chokolade	1.80	....	2.94	18.40	....	....	....	....	...
	Cocoa.									
	Callard & Co., London.									
1923	Biogene Cocoa	8.25	7.50	5.29	33.06	2.41	11.05[2]	19.82	17.91	417
	Cheltine Foods Co., Cheltenham, England.									
1923	Cheltine Milk Cocoa	7.75	5.14	7.53	47.06	2.11	8.91[2]	13.12	15.91	420
	The Dieto Food Co., New York City.									
1914	Dieto Cocoa	4.29	5.40	3.77	23.56	4.87	12.38	26.57	22.93	456

	H. and R. Diabetic Foods, Bronx, N. Y.									
1924	Cellu Cocoa Nibs	3.80	2.79	1.32	8.25	8.00	4.23[2]	42.83	30.10	492
	Jireh Diabetic Food Co., New York City.									
1906	Diabetic Cocoa	3.10	4.30	3.30	20.60	3.60	32.60[2]	18.00	17.80	445
1906	Diabetic Cocoa	7.30	3.90	3.06	19.10	3.40	29.00[2]	18.90	18.40	434
	Loeb's Diabetic Food Bakery, New York City.									
1923	Diabetic Cocoa	4.98	5.47	5.29	33.06	3.62	12.64[2]	22.34	17.89	433
1923	Diabetic Cocoa	4.90	5.80	4.07	25.44	3.83	16.03[2]	23.09	20.91	446
	Gustav Müller, New York City (Agent).									
1913	Charrasse Gluto-Cacao	6.40	6.70	3.44	21.50	3.10	16.30	23.80	22.20	446
	Plasmon Co., London.									
1903	Plasmon Cocoa	8.90	6.60	8.45	52.80	....	5.10	15.80[3]	10.80	392
1921	Plasmon Cocoa	9.82	7.74	8.07	50.44	1.33	6.01[2]	13.07	11.59	382
	Rademann's Nährmittelfabrik, Frankfurt									
1913	Diabetiker-Cacao	5.20	5.90	2.82	17.60	3.00	10.70	34.00	23.60	462
	Miscellaneous Products. *Callard & Co., London.*									
1923	Cibrola	11.31	10.86	11.94	76.18	0.00	0.19[4]	1.06	0.40	313
1923	Ponos Cocoanut Ice[5]	7.85	1.29	1.38	....	1.19	3.12[2]	....	36.18	338
1923	Sugarless Jujubes (peppermint)[6]	21.70	0.40	3.01	....	none	trace[2]	....	....	...
1923	Sugarless Jujubes (pineapple)[6]	19.76	0.35	2.89	....	none	trace[2]	....	....	...
1923	Sugarless Table Jelly[7]	8.68	0.42	4.50	....	none	trace[2]	....	....	...
	Dieto Food Co., New York City.									
1914	Dieto Baking Powder	....	....	....	....	....	12.94	....	....	...
1914	Dieto Barley Coffee	3.42	3.08	2.11	13.19	9.14	17.72	46.15	7.30	374
	Manual Freres.									
1917	Longuets de Lausanne	10.78	3.04	2.27	14.19	0.44	49.16	16.86	5.53	370

[1] Includes 36.52 per cent water-soluble carbohydrates.
[2] Includes water-soluble carbohydrates.
[3] Includes fiber.
[4] Lactose.
[5] Saccharin present; glycerine indicated.
[6] Glycerine present; gelatin indicated.
[7] Saccharin present; gelatin indicated.

Table II. Analyses of Special Foods—*Continued.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Undetermined carbohydrate	Fat	Calories per 100 gms.
	Miscellaneous Products—Concluded.									
	Health Food Co., New York City.	%	%	%	%	%	%	%	%	
1913	Kaffeehrod	4.50	2.20	2.06	12.90	6.40	10.10	62.40	1.50	355
	Genevieve Jackson, Los Angeles, Calif.									
1919	Dia-Biskit	6.08	6.13	2.82	17.63	11.99	6.13[1]	47.21	4.83	328
	The Kellogg Food Co., Battle Creek, Mich.									
1911	Sanitas Meltose	26.80	0.50	0.10	0.60	....	....	72.10[2]	....	291
	Lister Bros., Inc., New York City.									
1923	Lister's Sugar-free Candy[3]	0.44	1.41	3.67	....	none	trace[4]	....	....	...
	Mansfield Laboratories, Mansfield, Mass.									
1923	No Name (square)	9.34	5.53	4.72	29.50	0.43	34.26	13.53	7.41	376
1914	No Name (hexagonal)	8.65	4.84	4.06	25.38	0.47	31.16	14.33	15.17	420
	Gustav Müller & Co., New York City.									
1913	Dr. Bouma Sugar-free Milk	91.80	0.50	0.38	2.40	....	....	....	5.30	57
	S. S. Pierce Co., Boston, Mass. (prepared for).									
1919	Svea Wafers	10.58	2.85	1.04	6.50	0.13	53.72	25.53	0.69	349
1900	Diabetes Milch, 5%, *Rose's*	92.50	0.20	0.18	1.10	....	....	1.20	5.00	54
1900	Diabetes Milch, 10%, *Rose's*	86.30	0.20	0.37	2.30	....	....	1.20	10.00	104
	La Societie L'Aliment "Essentiel," Nanterre, France.									
1921	"Essentiel" Food, Cacao Flavor	4.62	1.48	1.47	9.19	0.78	63.30[5]	16.21	4.42	395
1921	"Roburol" with Cacao	4.70	3.16	3.26	20.38	0.75	46.56[6]	20.34	4.11	386

	D. Whiting & Sons, Boston, Mass.									
1913	Sugar-free Milk (ave. 3 analyses)	86.40	0.70	0.91	5.70	....	....	trace	7.20	88
1919	Sugar-free Milk	83.30	0.76	1.01	6.43	....	....	0.22[7]	9.34	111
1922	Sugar-free Milk	83.51	0.76	....	6.62[8]	....	....	0.55[7]	8.56	106
	Fruits and Vegetables (Canned). *Callard & Co., London.*									
1925	Cranberries, Callard's Sugarless Fruit	82.24	0.14	0.05	0.31	1.00	1.33[9]	([10])	....	...
1925	Plums, Callard's Sugarless Fruit	76.44	0.17	0.04	0.25	0.28	1.46[9]	([10])	....	...
	The Diaprotein Co., Columbus, Ohio.									
1921	Apple Sauce	88.69	0.58	0.03	0.18	0.47	5.75[4]	3.72	0.61	44
1921	Blackberries	91.80	0.29	0.11	0.67	1.76	2.57[4]	2.41	0.50	27
1921	Cherries, Red, Pitted	90.39	0.34	0.08	0.50	0.13	5.14[4]	3.36	0.14	37
1921	Cherries, White	91.26	0.45	0.11	0.71	0.18	3.79[4]	3.47	0.14	33
1921	Peaches, Yellow	93.38	0.31	0.08	0.47	0.38	2.88[4]	2.52	0.06	24
1921	Pears, Bartlett	93.57	0.17	0.05	0.28	0.62	2.54[4]	2.72	0.10	51
1921	Raspberries, Red	88.34	0.47	0.14	0.88	2.67	3.00[4]	3.96	0.68	37
1921	Strawberries	93.58	0.32	0.09	0.57	0.82	1.95[4]	2.40	0.36	23
1921	Beans, Cut, Wax	96.20	0.27	0.13	0.83	0.99	1.15[4]	0.51	0.05	10
1921	Beans, Refugeè, Green	94.43	1.36[11]	0.11	1.04	0.88	1.43[4]	0.80	0.06	14
1921	Peas, Green	88.74	0.37	0.51	3.19	1.27	3.02[4]	2.15	0.36	40
1921	Rhubarb	96.35	0.51	0.07	0.41	0.54	0.27[4]	1.88	0.04	11
1921	Spinach	91.46	2.39[12]	0.49	3.08	0.93	0.56[4]	0.98	0.60	24
1921	Tomatoes	95.07	0.53	0.17	1.04	0.32	1.48[4]	1.34	0.22	17
	The Poms Co., Sarasota, Fla.									
1924	Poms (Canned Grapefruit)	90.54	0.36	....	0.49	0.17	4.24[9]	4.09	0.11	36
	John Sexton & Co., Chicago.									
1924	Edelweiss Apricots	90.50	0.46	....	0.39	0.35	4.38[9]	3.81	0.11	35
1924	Pride of the West Apricots	90.58	0.48	....	0.37	0.34	4.81[9]	3.32	0.10	35
1924	Alp Rose Blackberries	85.33	0.33	....	0.96	2.29	5.59[9]	4.84	0.66	52
1924	Alp Rose Blueberries	85.89	0.25	....	0.44	0.95	7.60[9]	4.53	0.34	53

[1] Includes some reducing material derived from agar-agar.
[2] Includes fiber.
[3] Gums, saccharin, glycerine and gelatin present.
[4] Includes water-soluble carbohydrates.
[5] Includes 35.47 per cent water-soluble carbohydrates.
[6] Includes 26.80 per cent water-soluble carbohydrates.
[7] Lactose.
[8] Includes 0.37 per cent gelatin.
[9] All water-soluble carbohydrates; no starch.
[10] Packed with glycerine; manufacturer's statement.
[11] Includes 1.04 per cent salt.
[12] Includes 1.00 per cent salt.

TABLE II. ANALYSES OF SPECIAL FOODS—*Concluded.*

Date of analysis	Manufacturer and Brand	Water	Ash	Nitrogen	Protein	Fiber	Carbohydrate (other than fiber) Starch	Carbohydrate (other than fiber) Undetermined carbohydrate	Fat	Calories per 100 gms.
	Fruits and Vegetables (Canned)—Concluded.									
	John Sexton & Co., Chicago—Concluded.	%	%	%	%	%	%	%	%	
1924	Edelweiss Cherries	89.71	0.32	....	0.64	0.14	4.24[1]	4.86	0.09	40
1924	Pride of the West Cherries	88.76	0.32	....	0.57	0.12	4.88[1]	5.24	0.11	44
1925	Alp Rose Black Cherries	82.60	0.40	0.09	0.56	0.19	9.95[1]	6.04	0.26	69
1925	Alp Rose Red Pitted Cherries	86.76	0.34	0.08	0.51	0.19	6.99[1]	4.94	0.27	52
1924	Alp Rose Royal Ann Cherries	86.18	0.36	....	0.63	0.15	7.58[1]	5.05	0.05	14
1924	Alp Rose Grapefruit	90.49	0.43	....	0.69	0.17	4.87[1]	3.30	0.05	36
1924	Alp Rose Logan Berries	85.43	0.34	....	1.04	1.82	5.60[1]	5.09	0.68	53
1924	Edelweiss Peaches	91.73	0.31	....	0.37	0.26	4.04[1]	3.24	0.05	31
1924	Pride of the West Peaches	91.72	0.31	....	0.38	0.24	4.76[1]	2.55	0.04	31
1924	Alp Rose Bartlett Pears	89.17	0.21	....	0.26	0.61	4.31[1]	5.34	0.10	41
1924	Edelweiss Pears	90.35	0.23	....	0.24	0.56	3.70[1]	4.82	0.10	36
1924	Pride of the West Pears	90.52	0.20	....	0.24	0.63	3.60[1]	4.72	0.09	35
1924	Alp Rose *Pineapple, Hawaiian Sliced*	85.81	0.35	....	0.36	0.27	8.49[1]	4.61	0.11	55
1924	Pride of the West Pineapple	86.17	0.30	....	0.38	0.28	9.65[1]	3.17	0.05	53
1924	Alp Rose Japan Plums	93.33	0.27	....	0.29	0.29	2.83[1]	2.93	0.06	25
1924	Alp Rose Prune Plums	88.63	0.33	....	0.33	0.21	6.92[1]	3.50	0.08	44
1924	Pride of the West Prune Plums	88.88	0.30	....	0.39	0.21	4.83[1]	5.27	0.12	43
1925	Alp Rose Black Raspberries	87.98	0.39	0.13	0.81	2.58	3.34[1]	3.83	1.07	42
1924	Alp Rose Red Raspberries	89.02	0.31	....	0.67	1.69	4.81[1]	3.00	0.50	34
1925	Alp Rose Strawberries	93.83	0.30	0.07	0.43	0.72	2.03[1]	2.37	0.32	22
1924	Alp Rose Peeled White Asparagus	95.76	0.35	....	1.20	0.34	1.49[1]	0.80	0.06	15
1924	Alp Rose White Asparagus Tips	94.81	0.43	....	1.65	0.42	1.63[1]	0.97	0.09	18
1925	Alp Rose Refugee Beans (small green)	95.26	0.33	0.17	1.03	0.48	1.44[2]	1.41	0.05	16
1925	Alp Rose Beets (small)	84.17	0.48	0.20	1.28	1.04	8.39[2]	4.59	0.05	57
1925	Alp Rose Peas (sifted Early June)	90.16	0.32	0.42	2.64	1.06	4.17[2]	1.45	0.20	35

1925	Edelweiss Sauer Kraut	93.60	1.77[3]	0.18	1.10	0.66	0.41[2]	2.31	0.15	17
1925	Alp Rose Spinach	91.94	1.17[4]	0.46	2.87	0.65	0.99[2]	1.92	0.46	27
1925	Alp Rose Sweet Corn	83.23	0.53[5]	0.34	2.11	0.31	10.27[2]	2.46	1.09	69
	Washington County Co., Dennysville, Me.									
1925	Aunty's Mountain Cranberries	82.76	0.24	0.08	0.48	1.01	3.28[2]	11.39	0.84	68
1925	Aunty's Blueberries	81.35	0.28	0.10	0.66	1.53	8.04[2]	7.21	0.93	69
	Preserves, etc. *Callard & Co., London.*									
1925	Sugarless Jam (Apricot)	61.62	0.43	0.71	3.94[6]	0.30	3.34[1]	([7])	....	...
1925	Sugarless Jam (Green Gage Plum)	60.68	0.39	0.90	5.00[6]	0.29	2.75[1]	([7])	....	...
1925	Sugarless Marmalade (Orange)	59.64	0.37	1.04	5.77[6]	0.55	1.15[1]	([7])	....	...
1925	Sugarless Jelly (Pineapple)	80.44	0.28	1.23	6.83[6]	none	none[2]	([7])	....	...
1925	Sugarless Jam (Plum)	67.42	0.33	0.90	5.00[6]	0.28	1.68[1]	([7])	....	...

[1] All water-soluble carbohydrates; no starch.
[2] Includes water-soluble carbohydrates.
[3] Includes 1.29 per cent salt.
[4] Includes 0.06 per cent salt.
[5] Includes 0.04 per cent salt.
[6] Calculated as gelatin.
[7] Packed with glycerine; manufacturer's statement.

BULLETIN 287 MAY, 1927

Connecticut Agricultural Experiment Station

New Haven, Connecticut

The Thirty-First Report on

FOOD PRODUCTS

and the Nineteenth Report on

DRUG PRODUCTS

1926

Part II

Food and Drug Inspection

By
E. M. BAILEY

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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as of

May, 1927

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CONTENTS AND SUMMARY.

Material	Page	Sampled by, or Submitted to: The Station	Sampled by, or Submitted to: The Dairy and Food Commissioner	Total	Adulterated, below standard, or otherwise illegal
FOODS					
Baking Powder, etc.	363	1	7	8	3
Bread	364	4	0	4	0
Carbonated Beverages, etc.	365	0	184	184	29
Cocoa	366	2	0	2	0
Coffee	366	0	1	1	0
"Diabetic" and Special Foods	366	30	0	30	...
Eggs	366	1	40	41	25
Fats and Oils:					
Butter	366	0	5	5	0
Oleomargarine, etc.	366	0	4	4	2
Olive Oil	367	1	5	6	1
Flavoring Extracts:					
Almond	368	0	6	6	0
Vanilla	368	0	1	1	0
Gelatin	368	1	0	1	...
Ice Cream	368	3	385	288	3
Frozen Pudding, etc.	369	1	3	4	...
Ice Cream Cones	369	0	12	12	0
Meat Products:					
Beef Loaf	370	0	1	1	0
Frankfurts, Bologna, etc.	370	0	21	21	15
Hamburg Steak	371	1	3	4	1
Milk and Milk Products:					
Market Milk	371	232	556	788	199[1]
Evaporated Milk	373	1	0	1	...
Cream	373	12	0	12	...
Human Milk	373	2	0	2	...
Spices:					
Mace	373	0	13	13	5
Mustard, Prepared	375	0	12	12	...
Paprika	377	0	14	14	2
Syrup	377	1	0	1	...
Vinegar	378	11	8	19	...
Miscellaneous Foods, etc.	378	13	0	13	...
Total		317	1181	1498	285

[1] Includes 148 below standard only.

CONTENTS AND SUMMARY—*Concluded.*

Material	Page	Sampled by, or Submitted to: The Station	Sampled by, or Submitted to: The Dairy and Food Commissioner	Total	Adulterated, below standard, or otherwise illegal
DRUGS, ETC.					
Arsenous and Mercuric Iodide, Solution of	381	0	2	2	2
Camphor, Spirit of	381	0	31	31	1
Camphor Liniment	383	0	28	28	6
Dichloramine, etc.	384	0	5	5	0
Formaldehyde, Solution of	385	0	8	8	1
Magnesium Citrate, Solution of	385	1	2	2	...
Potassium Iodide	386	2	0	2	1
Tablets, Hypodermic	386	0	2	2	1
Proprietary Remedies, etc.	386	6	0	6	...
Materials Examined for Poisons, etc.	388	33	0	33	...
Analyses of Factory Wastes, etc. (State Water Commission)	390	5	0	5	...
Total		47	78	124	12
Total for Foods and Drugs		364	1259	1622	297
Babcock Glassware	390	2435	0	2435	64

The Thirty-first Report on Food Products and the Nineteenth Report on Drug Products

PART II

Food and Drug Inspection and Analysis

By E. M. BAILEY

This part of the annual report on foods and drugs summarizes the work done in the calendar year of 1926, chiefly for purposes of inspection and control as required by the Dairy and Food Commissioner.

Some collaborative work upon methods of analysis has been done for the Association of Official Agricultural Chemists. A unit representing the progress of food control in this State was prepared as a part of the Station's exhibit at the New Haven Progress Exposition. An index[1] to the foods and drugs examined in the department for the ten-year period ending Dec. 31st, 1925, and now published, was also a part of the year's work. The chemist in charge has served as a member of the Executive Committee and of the Committee on Recommendations of Referees of the Association of Official Agricultural Chemists; as a member of the Joint Committee of Definitions and Standards; and as a consultant to the Council on Pharmacy and Chemistry of the American Medical Association.

For the analytical work herein reported credit is due to Messrs. Andrew,[2] Shepard, Fisher, Nolan and Mathis and to Miss Bacon for assistance in preparing reports.

I. FOODS.

Baking Powder, etc.

Seven samples of baking powder were examined for available carbon dioxide and metallic impurities. Baking powder should contain not less than 12 per cent of available carbon dioxide.

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[1] Conn. Exp. Station. Bull. 284, 1927.
[2] Resigned, March, 1926.

TABLE I. ANALYSES OF BAKING POWDER.

No.	Brand	Available carbon dioxide %
31779	Davis Co., R. B. *Davis*	13.4
31767	Great A. & P. Tea Co., *Red Front*	13.4
31780	Royal Baking Powder Co., *Royal*	12.8
31781	Rumford Chemical Works, *Rumford*	12.7
31759	Slade Co., D. & L.	9.1 (total)
34769	Slade Co., D. & L.	7.2
34651	Van Dyk Co., James, *Van Dyk's*	10.5

Samples **31759** and **34769** were purchased of M. J. Babaian, 397 Capitol Ave., Hartford. Both samples were considerably below standard. No. **34651** was purchased of James Van Dyk Co., Asylum St., Hartford, and was somewhat deficient in available carbon dioxide.

None of the brands contained arsenic in excess of 1 part per million.

A sample of Cream of Tartar Substitute, **4849**, declared to contain monobasic sodium phosphate and corn starch was found to contain 30.7 per cent of starch.

BREAD.

Four samples of bread were submitted. Two, **5560**, **5561**, were from the New Haven County Jail and two, **3456**, **3457**, were sent by Dr. C. E. McCauley of Aberdeen, S. D.

Samples **5560**, **5561** and **3457** are wheat bread. Sample **3456** is Dr. Gordon's Health Bread made from whole wheat flour and honey said to be recommended as a natural regulator and effective in reducing diets, and manufactured by the Federal System of Bakeries.

The analyses are as follows:

TABLE II. ANALYSES OF BREAD.

Number	5560 %	5561 %	3456 %	3457 %
Moisture	37.15	35.40	31.58	29.89
Ash	1.43	1.63	3.12	1.62
Protein	9.01	8.92	10.28	9.63
Fiber	0.26	0.17	1.35	0.24
Carbohydrate:				
Starch	51.30	51.63	24.84	42.93
Soluble, as dextrose			15.88	8.78
Undetermined			8.35	3.50
Fat	0.85	2.25	4.60	3.41
Calories per 100 gms.	249.0	262.0	279.0	290.0

From a comparison of energy values the reducing effect of sample **3456** is likely to be disappointing.

Carbonated Beverages.

One hundred and seventy-nine samples of carbonated beverages were examined.

The law requires a sugar content of not less than 5 per cent in these products; saccharin is prohibited and artificial colors and flavors must be declared if used. Benzoate of soda is the only chemical preservative recognized in the regulations and its presence requires label declaration.

Recently hydrogen peroxide has been used to some extent as a preservative in bottled chocolate beverages. It is claimed that, due to the fact that this substance readily decomposes into oxygen and water, the preservative, as such, will not be found in the beverages so treated. There is evidence, however, that the peroxide may persist for some time particularly in beverages which are bottled without subsequent heating.

The apparently harmless nature of hydrogen peroxide[1] when used as a remedial agent or, according to older literature, as a preservative for certain foods, is not necessarily an argument in favor of its unrestricted use in foods, and control officials have generally adopted a conservative attitude with respect to its use for food preservation. One obvious objection to it, and to any other substance used for similar purposes, is the tendency it will have to create a disregard for those sanitary safeguards in manufacturing operations which food officials have emphasized and which manufacturers have so largely adopted. Again, commercial preparations of hydrogen peroxide are themselves preserved with mineral acids and other chemicals, and these "stabilizers," although in small amounts, are necessarily introduced into peroxide-treated beverages.

For the present no objection is raised in this State to chocolate beverages so treated provided the treatment is not in lieu of proper sanitary measures in the plant; and provided that the peroxide, as such, is not present in the finished product; and further provided that evidence of objectionable stabilizers is not found.[2]

All of the samples examined contained the required amount of sugar. Saccharin was found in seven samples but they were all the product of one manufacturer, the Washington Club Bottling Works of Norwich. Five samples of chocolate soda were tested for hydrogen peroxide; four showed no trace of the preservative and one showed the merest trace. Considerable laxity was noted in the matter of declaring artificial flavors and colors, twenty-two samples being deficient in this respect.

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[1] Rideal, Disinfection and Preservation of Food, 1903; Thresh and Porter, Preservatives in Food and Food Examination, 1900; Sollmann, Manual of Pharmacology, 1917; U. S. Dispensatory, twentieth edition.

[2] The revised rules and regulations will probably include hydrogen peroxide with those preservatives which are prohibited.

Five samples of preservative solutions (hydrogen peroxide) were examined; four were dilute (approximately 3 per cent) solutions and one was a strong solution (about 30 per cent).

Cocoa.

Two samples of cocoa being served in public schools were examined for Mrs. Weldon of Glastonbury. The chief difference between them was in the item of fat, one containing 21.8 per cent and the other 13.5 per cent.

Coffee.

One sample of coffee, 34420, submitted by the Dairy and Food Commissioner was examined and no evidence of chicory or of other foreign substances was found.

So-called Diabetic and Special Foods.

Thirty samples of products of this class were examined but the analyses are given in Part I of this report[1] and no discussion of them is required here.

Eggs.

Forty samples of market eggs were submitted by the Dairy and Food Commissioner. By candling and determining ammoniacal nitrogen 15 samples were passed as fresh and 25 did not have the characteristics of fresh eggs.

One sample of "dipped" eggs (eggs dipped in oil) was also examined. A small quantity of oil with a refraction of about 72 at 25° C. was extracted from the shell. A sample suspected of being dipped yielded no oil when the shell was extracted. The dipped eggs showed a relatively high ammoniacal nitrogen content (2.7 mgms. per 100 gms. of egg), and the yolks were settled in the shell. Air spaces were, however, generally less than 1 inch in diameter. The eggs were wholesome and edible but did not have the characteristics of fresh eggs excepting the fairly small air spaces.

Fats and Oils.

BUTTER.

One sample of butter and four of sweet butter have been examined and all found to be genuine and to contain no excess of water (less than 15.99 per cent).

OLEOMARGARINE.

Two samples of oleomargarine were examined and no evidence of added artificial coloring matter was found.

[1] *Conn. Exp. Station, Bull. 286, 1927.*

Two samples of so-called cooking fats known as Danish Nut Product (Danish Packing Co., Providence, R. I.), and Nut Product, Verco Brand (Vermont Products Co., Providence, R. I.), were examined. Analyses are given in Table III.

These products are artificially colored and sold as cooking fats and not as oleomargarine. A Federal court decision has exempted one of them (Danish Nut Product), from classification as oleomargarine.[1]

Section 2449, General Statutes, defines imitation butter or oleomargarine as any article resembling butter and not made wholly from milk or any product of milk, salt and coloring excepted.

These two "cooking fats" admittedly contain no milk or milk product and analysis shows no evidence of such constituents. The compounds do resemble butter, however, by reason of their chemical composition, their appearance and taste and their other physical properties which determine their use as edible fats or for cooking purposes.

From the standpoint of composition these products bear substantially the same resemblance to butter as do certain other articles generally recognized as oleomargarines, viz., vegetable oil margarines. To classify them as cooking fats is to place them with products which they least resemble.

In appearance they resemble butter and their taste also suggests or resembles that of butter.

Cooking fats are practically 100 per cent fat; they contain no water or but traces thereof, and they contain no salt. They are particularly suited for deep frying to which purpose butter and oleomargarine are entirely unsuited because of their considerable water content. Danish Nut Product and Verco Nut Product are "cooking fats" only insofar as butter and oleomargarine may be so called.

Moreover, it is clear from recipes in which one of these products is recommended for use that it can be used only where butter and oleomargarine can be used and in no case where they cannot be employed. In other words, these so-called "cooking fats" are substitutes for butter and not for lard.

OLIVE OIL.

Six samples of olive oil were examined, five of them for the Dairy and Food Commissioner. One sample, Italia brand, No. **33866**, sold by the Italian Coöperative Store, Hartford, was adulterated with sesame oil.

[1] Treasury Decision 4006, approved April 1st, 1927, holds that these so-called cooking compounds sufficiently resemble butter to warrant their classification as oleomargarine.

TABLE III. ANALYSES OF COOKING FATS, BUTTER, ETC.

	Water %	Ash (Salt) %	Nitrogen (calculated as casein) %	Fat %
Cooking fats (7 analyses). (Wesson oil, Mazola, Cottolene, Crisco, etc.).				
Maximum	0.31	0.08	0.38	100.00
Minimum	0.00	0.00	0.00	99.53
Average	0.07	0.03	0.20	99.68
Butter (12 analyses). (Connecticut Creamery).				
Maximum	15.88	4.05	2.21	88.59
Minimum	8.52	0.21	1.21	80.93
Average	12.24	1.59	1.51	84.62
Animal Oil, Oleomargarine (5 analyses).				
Maximum	9.20	3.08	1.25	97.36
Minimum	1.67	0.41	0.56	86.72
Average	5.37	1.43	0.80	92.40
Vegetable Oil Oleomargarine (8 analyses).				
Maximum	12.64	6.06	2.71	91.20
Minimum	6.53	1.14	0.69	81.75
Average	10.99	2.85	1.39	84.77
Danish Nut Product, etc.				
1923—Nut-z-all	10.73	1.37	0.26	87.58
1925—Higgin's Nut Product	9.80	2.30	0.00	87.90
1926—Danish Nut Product	12.54	2.79	0.17	84.50
1926—Verco Nut Product	10.87	5.50	0.29	83.34

FLAVORING EXTRACTS.

Six samples almond extract and one of vanilla extract were examined and all were passed. Almond extract should be free from hydrocyanic acid and no evidence of this substance was found in any of the samples examined.

GELATIN.

One sample of gelatin was examined for a physician to determine the amount of salt present. The equivalent of 0.36 per cent of sodium chloride was estimated from the chlorine in the ash.

ICE CREAM.

Two hundred and eighty-five official samples of ice cream were examined and three were tested for individuals.

Only three samples contained less than the legal fat standard of 8 per cent for plain ice cream and 6 per cent for fruit and nut ice cream.

These three deficient samples are as follows:

No.		Dealer	Manufacturer
31972	*New Haven*	S. Vitale	Own make (?)
34690	*New Britain*	Chas. Picalo	Own make
33883	*Norwich*	G. Gressell	Own make

The distribution of samples on the milk fat basis is as follows:

Per cent of fat	No. of samples 1926	Per cent of total 1926	Corresponding percentage 1925	1924	1919-23
8.0 to 9.9	15	5.2	17.0	17.4	26.1
10.0 to 11.9	78	27.4	34.6	24.8	26.1
12.0 and above	189	66.3	46.7	55.9	41.1
7.9 and below	3	1.1	1.7	1.9	9.6

In the five-year period 1919-23 about ¼ of the samples examined contained from 8 to 10 per cent fat; the percentage of samples of this grade has decreased since that time and the corresponding percentage for 1926 is about 5 per cent. There has been a gradual increase in the proportion of samples containing over 12 per cent of fat; during the past year (1926), about ⅔ of the samples examined were of that grade.

These data, for the past year at least, represent for the most part the products of smaller establishments, and without information as to the gross production of the several grades it is not possible to state the average percentage of fat in ice cream as produced in this state to-day.

A federal standard of 12 per cent milk fat for ice cream, proposed by the Joint Committee on Definition and Standards, is opposed by the ice cream industry. Manufacturers generally favor an 8 per cent standard; but many of these are making products which test nearer 12 per cent than 8.

FROZEN PUDDING.

Products resembling ice cream and sold under the name of "frozen pudding" and similar labels have been held in this state to be subject to the regulations governing the manufacture and sale of ice cream. If they contain less than 8 per cent of milk fat the percentage of fat must be declared by a suitable sign displayed at the time and place of sale.

ICE CREAM CONES.

Twelve samples of the pastry cones in which ice cream is dispensed were examined for saccharin but none was detected.

Meat Products.

BEEF LOAF.

One sample of beef loaf was examined for presence of cereal and found to contain 4.96 per cent of starch. No label declaration of cereal is required for beef loaf.

FRANKFURTS, ETC.

Twenty-one samples of frankfurt sausage, bologna, etc., were examined, fifteen of which were found to contain undeclared cereal, or undeclared color, or both. This proportion is not to be understood to indicate the extent of adulteration or misbranding of meat products because samples submitted to us were only such as were suspected by the inspectors.

Deficient samples found are as follows:

No.	Dealer	Manufacturer	Remarks
	Ansonia		
33227	Chas. Powanda..	F. J. McNamara & Sons	Cereal undeclared
	Bridgeport		
33085	Peter Hron, Inc.	Own make	Cereal undeclared
33080	The Mohican Co.	F. Flaxington	Cereal undeclared
33081	The Mohican Co.	F. J. McNamara & Sons	Cereal undeclared
	Bristol		
33093	Central Beef & Provision Co..	Own make	Cereal undeclared
	Meriden		
34782	H. Brown	F. J. McNamara & Sons	Cereal undeclared
	New Britain		
33201	A. Y. O. Provision Co.	....	Cereal undeclared
33091	B. Berkowitz ...	New England Food Products Co.	Cereal undeclared
33088	M. Zaleski	Central Beef & Provision Co.	Cereal undeclared
	New Haven		
33210	Carl Rossler ...	....	Cereal and color undeclared
	Norwich		
33202	Sachem Provision Co.	Hartford Center Bologna Co.	Cereal undeclared
	Putnam		
33203	E. W. Mullan ..	Geo. Bockper Co., Worcester, Mass.	Cereal undeclared
33204	Pomfret Market	....	Cereal undeclared
	Windsor Locks		
33226	J. Borracci	....	Color undeclared
33208	....	....	Cereal undeclared

"Cereal" has been regarded as present when starch in excess of that reasonably attributable to spice starch has been found. It is recognized that non-cereal starchy materials such as buckwheat flour and potato flour may have been used.

Manufacturers should note that the use of milk powder in sausage requires a label declaration.

HAMBURG STEAK.

Three samples of hamburg steak submitted by the Dairy and Food Commissioner were examined and no evidence of sulphites found.

Another sample submitted by the Fulton Markets, Waterbury, on advice of the Dairy and Food Commissioner was found to contain 574 milligrams of sulphite per kilo.

Milk and Milk Products.

MARKET MILK.

Five hundred and fifty-six samples of milk were examined for the Dairy and Food Commissioner, three hundred and seventy-seven of which were taken in official inspections.

Two hundred and thirty-two samples were examined for individuals, making a total of seven hundred and eighty-eight.

The distribution of official samples, based upon analysis, is as follows:

	No. of samples	Per cent
Not found adulterated	178	47.2
Adulterated by watering	51	13.5
Below standard:		
in solids and solids-not-fat	78	20.7
in solids and fat	5	1.3
in solids, fat and solids-not-fat	65	17.3
Totals	377	100.0

Deficient samples are listed in Table IV.

TABLE IV. ADULTERATED MILK.

No.	Dealer	Solids	Fat
	Containing Added Water.		
	Bethel.		
31660	John Takacs	8.40	2.5
31661	John Takacs	8.57	2.6
31662	John Takacs	9.19	3.1
31663	John Takacs	8.96	2.8
	Bridgeport.		
33177	Sylvester Cocivi ...	10.27	3.1
33178	Sylvester Cocivi ...	10.40	3.1
33179	Sylvester Cocivi ...	10.26	3.3
33169	Geo. Gregory	10.06	2.8
33170	Geo. Gregory	10.13	3.0
33171	Geo. Gregory	9.98	2.9
33183	Christian Peterson..	10.43	3.4
33184	Christian Peterson..	11.30	3.7
	Brookfield.		
33512	Steve Piskura	10.29	3.2
33513	Steve Piskura	10.23	3.0
	Brookfield Center.		
33523	A. Sobriewitz	10.67	3.1
	Durham.		
33166	W. S. Cornell	10.55	3.1
33167	John Sigilini	10.67	3.5
33168	John Sigilini	10.77	3.6
	East Windsor.		
33418	J. S. Allen	10.67	3.1
33419	J. S. Allen	10.70	3.0
	Hawleyville.		
33520	W. S. Hawley	9.05	2.5
33521	W. S. Hawley	9.90	3.1
33522	W. S. Hawley	9.67	3.1
32131	Ralph Talarico	11.05	3.5
32132	Ralph Talarico	9.84	2.6

No.	Dealer	Solids	Fa
	Containing Added Water—Concluded.		
	New Britain.		
33118	J. E. Callahan	9.92	3.
33119	J. E. Callahan	10.97	3.
33120	J. E. Callahan	11.34	3.
33121	J. E. Callahan	10.43	2.
33122	J. E. Callahan	10.40	3.
	Northford.		
34324	John Sigalini	11.19	3.
	Ridgefield.		
33145	Geo. Cable	10.82	3.
33146	Geo. Cable	12.39	5.
33147	Geo. Cable	11.47	3.
	Shelton.		
35196	Stanley Fritz	10.30	3.
35197	Stanley Fritz	10.47	3.
35200	J. Suren	10.74	3.
35201	J. Suren	10.12	3.
35202	J. Suren	10.59	3.
35203	J. Suren	10.63	2.
	Waterbury.		
34828	E. L. Bronson	10.26	2.
34825	John Coscia	10.40	3.
	Westport.		
33132	John Fike	12.11	4.
33133	John Fike	11.24	3.
33134	John Fike	11.70	4.
	Willimantic.		
31449	Louis A. King	11.23	3.
33600	Louis A. King	11.76	4.
	Wilton.		
33131	Vincent Fito	10.54	3.
33136	Arthur Little	11.30	3.
33129	Edward Mills	10.43	3.
33130	Edward Mills	10.39	3.

EVAPORATED MILK.

One sample of evaporated milk, brand not given and not in the original container, was examined for the Board of Health of Norwalk. The sample was low in fat but no off-taste was noted.

CREAM.

Eight samples of cream were examined in a series of tests to detect added water cryoscopically. This work was done by Mr. Mathis in collaboration with the Referee on Dairy Products of the Association of Official Agricultural Chemists, and is reported elsewhere.[1]

Four other samples were examined for fat or for preservatives. No preservatives were found.

HUMAN MILK.

Two samples of human milk were examined for physicians.

SPICES.

MACE.

Thirteen samples of mace were submitted by the Dairy and Food Commissioner. Six were passed and seven were below standard.

Standard mace contains not less than 20 per cent nor more than 30 per cent of non-volatile ether extract, not more than 10 per cent of crude fiber, not more than 3 per cent of total ash, and not more than 0.5 per cent of ash insoluble in hydrochloric acid.

Analyses are given in Table V.

The deficiencies are chiefly excessive total ash usually accompanied by excesses of insoluble ash. Non-volatile ether extract are somewhat low in three samples. Crude fiber is within the limits set by the standard but two samples are conspicuously higher than the others. Compared with authentic samples of mace no evidence of adulteration was detected microscopically.

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[1] Proceedings of the Assoc. of Off. Agr. Chemists, 1926.

TABLE V. ANALYSES OF MACE.

No.	Dealer	Manufacturer and brand	Non-volatile ether extract	Crude fiber	Total ash	Ash insol. in HCl
	Bristol.		%	%	%	%
33336	North Side Market	Wm. Boardman & Sons, Putnam	21.59	3.82	1.81	0.04
33355	W. B. Woodruff	R. C. Williams & Co., Royal Scarlet	18.36	4.48	2.87	0.52
34770	W. B. Woodruff	R. C. Williams & Co., Royal Scarlet	22.86	3.20	2.85	0.55
	Hartford.					
33344	Epstein Bros.	Austin Nichols Co., Sunbeam	17.65	4.65	3.95	1.20
34767	Epstein Bros.	Austin Nichols Co., Sunbeam	19.02	3.47	3.81	1.29
31756	A. H. Phillips, Inc.	A. Colburne Co.	22.25	3.62	1.98	0.03
	New Britain.					
33341	J. A. Spinetta	Stickney & Poor Spice Co.	22.07	4.95	2.52	0.15
33340	J. A. Spinetta	Williams & Carleton Co.	21.96	4.95	3.65	0.94
33771	J. A. Spinetta	Williams & Carleton Co.	25.67	3.92	3.69	1.00
	Stamford.					
31788	Atlantic & Pacific Tea Co.	Atlantic & Pacific Tea Co.	20.39	3.70	2.43	0.35
33348	Modern Grocery Co.	E. R. Durkee & Co.	21.39	4.45	2.49	0.25
31789	P. W. Shea	B. Fischer & Co., Inc.	20.88	8.65	4.64	0.43
34779	P. W. Shea	B. Fischer & Co., Inc.	22.64	8.33	4.79	0.51

PREPARED MUSTARD.

Twelve samples of prepared mustard were examined and analyses are given in Table VI.

According to the revised definition and standard for prepared mustard[1] the fat-, salt-, and sugar-free solids should contain not more than 24 per cent of carbohydrates (calculated as starch), not more than 12 per cent of crude fiber, and not less than 5.6 per cent of nitrogen. Sugar may or may not be used in the manufacture of this product.

In the analyses nitrogenous material is calculated as protein, 5.6 per cent of nitrogen being equivalent to 35 per cent of protein. Sugar was not determined and results have therefore been calculated to the fat- and salt-free solids. On this basis all of the samples conform substantially to the specifications noted above for nitrogen, fiber and "starch" excepting **33337** which is somewhat low in nitrogen and high in the other two items. If this sample contained sugar, the percentage of all of these constituents would be somewhat increased in the fat-, salt-, and sugar-free solids.

[1] Food Inspection Decision 192, June, 1923.

TABLE VI. ANALYSES OF PREPARED MUSTARD.

No.	Manufacturer	Water	Acidity (as acetic acid)	Total solids	Total ash	Salt	Other ash	Protein	Crude fiber	"Starch"	N-free extract	Fat
		%	%	%	%	%	%	%	%	%	%	%
31787	The Atlantic & Pacific Co., New York	77.83	2.56	19.61	4.68	3.43	1.25	4.47	0.99	2.44	4.85	4.62
33333	J. W. Beardsley's Sons, Newark, N. J.	79.48	2.87	17.65	4.02	3.06	0.96	3.75	1.21	2.27	3.95	4.72
31777	Beechnut Packing Co., Rochester, N. Y.	72.54	4.06	23.40	2.99	1.69	1.30	5.33	1.17	3.62	6.90	7.01
31755	James Butler, Inc., N. Y.	75.49	3.22	21.29	3.42	1.98	1.44	4.77	1.44	2.95	6.02	5.64
33346	Cruickshank Bros. Co., Pittsburgh, Pa.	73.04	4.08	22.88	4.78	3.20	1.58	5.29	1.21	2.96	5.35	6.25
31757	The R. T. French Co., Rochester, N. Y.	80.34	3.63	16.03	3.27	2.66	0.61	3.75	0.89	1.91	4.39	3.73
33334	Charles Gulden, Inc., N. Y.	77.03	3.60	19.37	2.90	1.58	1.32	4.61	0.98	2.55	5.29	5.59
33342	H. J. Heinz, Pittsburgh, Pa.	72.31	3.99	23.70	4.09	2.89	1.20	5.74	1.07	2.80	5.33	7.47
31773	Libby, McNeill & Libby, Chicago, Ill.	76.07	3.52	20.41	3.28	2.17	1.11	4.40	1.20	2.63	6.73	4.80
31776	Mustard Products, Inc., Brooklyn, N. Y.	76.23	3.44	20.33	3.62	2.35	1.27	4.91	0.91	2.31	5.72	5.17
33345	D. & L. Slade Co., Boston, Mass.	77.85	3.12	19.03	4.10	2.95	1.15	4.52	1.29	2.55	4.58	4.54
33337	Stickney & Poor Spice Co., Boston, Mass.	79.31	3.20	17.49	3.48	2.62	0.86	3.37	1.73	2.88	5.11	3.80

TABLE VI. ANALYSES OF PREPARED MUSTARD—*Continued.*
(In the Fat- and Salt-Free Solids.)

No.	Ash	Protein	Crude fiber	"Starch"	N-free extract
31787......	10.81	38.67	8.56	21.11	41.96
33333......	9.73	37.99	12.26	23.00	40.02
31777......	7.93	32.52	7.14	22.09	52.41
31755......	10.54	34.89	10.54	21.58	44.03
33346......	11.77	39.39	9.01	22.04	39.83
31757......	6.33	38.90	9.23	19.81	45.54
33334......	10.82	37.78	8.03	20.90	43.37
33342......	9.00	43.02	8.02	20.99	39.96
31773......	8.26	32.75	8.93	19.57	50.06
31776......	9.92	38.34	7.10	18.04	44.64
33345......	9.97	39.16	11.18	22.10	39.69
33337......	7.77	30.44	15.63	26.02	46.16

PAPRIKA.

Paprika is the dried fruit of the large-fruited red pepper, *Capsicum annum.* Hungarian paprika is paprika having the characteristic pungency and flavor of that grown in Hungary; while piementon or pimiento, sometimes called Spanish paprika, is paprika having the peculiar characters of that produced in Spain.

Paprika should not have over 8.5 per cent of total ash nor more than 1 per cent of insoluble ash. The iodine number of the extracted oil should not be less than 125 nor more than 136.[1]

Fourteen samples were examined. Two of these were infested with beetles and were evidently old stock. Analyses of the other samples are given in Table VII.

All of the samples conformed to the limits for ash and insoluble ash as fixed by the standard. Iodine numbers were determined and found to be somewhat lower than recorded by Doolittle and Ogden[2] for authentic samples of Hungarian and Spanish paprika, and lower also than the minimum standard. The values obtained ranged from 105 to 122 and averaged 113. An old but authentic sample of Hungarian paprika ground in the laboratory, including seeds but no stems, yielded 15.32 per cent of ether extract having an iodine number of 122.

SYRUP.

One sample of maple syrup, **3719**, was examined and passed.

Analysis: Solids 64.2 per cent; sucrose by polarization 59.6 per cent; ash 0.6 per cent; lead number 1.14.

[1] Circ. 136. Office of Secretary, U. S. Dept. Agr.
[2] Jour. Am. Chem. Soc., 30, 1481, 1908.

TABLE VII. ANALYSES OF PAPRIKA.

No.	Dealer	Manufacturer	Ash %	Ash insol. in HCl %	Ether extract %
	Bristol.				
33332	Public Market	R. T. French Co...	7.31	0.30	12.73
31764	Atlantic & Pacific Tea Co.	Atlantic & Pacific Tea Co.	8.01	0.46	11.92
	Hartford.				
31758	M. J. Babian	D. & L. Slade Co...	7.46	0.40	12.47
31760	Cooley-Larsen Co.	Williams & Carlton Co.	7.71	0.40	12.85
31768	Dubin Butter Co..	D. & L. Slade Co...	8.32	0.49	10.11
31763	Griffen's Delicatessen	Wm. Boardman & Sons	7.20	0.21	12.16
	New Britain.				
33339	J. A. Spinetta	Austin Nichols & Co.	8.00	0.33	13.76
	Plainville.				
33338	Eastwood & Foran	R. C. Williams & Co.	7.81	0.30	13.23
	Stamford.				
31753	James Butler, Inc.	James Butler, Inc.	7.80	0.39	13.13
33347	Modern Grocery Co.	E. R. Durkee & Co.	7.66	0.35	11.41
31751	The Samuel Price Co.	Mutual Spice Co...	8.17	0.49	17.15
33349	J. Sternbach	F. H. Leggett & Co.	7.97	0.67	12.66

VINEGAR.

Eight samples of vinegar were examined for the Dairy an Food Commissioner and all were passed.

Eleven samples submitted by individuals were also examined.

MISCELLANEOUS FOODS, ETC.

6224. *Penolia* Peanut Butter, made by the Bradley-Smith Co New Haven.

Analysis: Water 1.50 per cent; ash 2.64 per cent; protein 30.8 per cent; fiber 2.07 per cent; carbohydrate (by difference), 13.56 pe cent; fat 49.35 per cent.

3431. *Nu-Salt.* Eli Lilly & Co., Indianapolis. This i declared to be an iodized salt containing 97 per cent sodium chlo ide; 0.05 per cent sodium iodide; 0.95 per cent potassium chloride 1.00 per cent calcium sulphate; and 1 per cent sodium bicarbonat

Analysis: Moisture 0.59 per cent; iron and aluminum oxides non calcium oxide 0.62 per cent; magnesium oxide 0.02 per cent; potassiu oxide 1.00 per cent; sulphur trioxide 0.43 per cent; phosphorus per oxide 0.35 per cent; iodine 0.04 per cent; insoluble matter 1.15 p cent; carbon dioxide 0.42 per cent.

Calculated composition: Calcium phosphate 0.76 per cent; calciu sulphate 0.49 per cent; magnesium sulphate 0.06 per cent; sodiu

sulphate 0.18 per cent; potassium chloride 1.58 per cent; sodium iodide 0.05 per cent; sodium bicarbonate 0.80 per cent; sodium chloride 95.49 per cent; moisture 0.59 per cent.

The composition of the salt is substantially as claimed.

32813. *Ovaltine.* The Wander Co., Chicago, Ill.

Analysis: *Moisture* 1.65 per cent; ash 3.80 per cent; protein (N x 6.25), 13.44 per cent; fiber 0.18 per cent; starch none; sugars (as dextrose), 39.53 per cent; undetermined carbohydrate (largely dextrin), 35.32 per cent; fat 6.08 per cent.

A product of the same name was analyzed in this laboratory in 1917[1] in which an active amylase was present and a small amount of lecithin phosphoric acid was found. We have not examined the newer product for amylase or for lecithin phosphoric acid, but otherwise the composition is substantially the same as previously found. The label declaration implies a high vitamin content but we have made no biological tests for vitamin. The original sample examined was an English product claimed to be made from malt, milk and eggs.

34421. *Cereal Meal.* Cereal Meal Corporation, St. Louis, Mo. No analysis was made but microscopic examination indicated that the product is essentially a mixture of agar agar, bran, flaxseed and germ.

34418. *Grape Fruit,* canned, submitted by a purchaser. The sample contained about 3 per cent of sugar and 9 per cent of invert sugar in the liquid portion which was 44 per cent of the contents. The fruit was evidently canned without added sugar.

ACORNS.[2]

The analyses in Table VIII are of shelled acorns of various species as harvested in the fall and at the time of germination in the following spring after storage in earth during the winter.

Starch was determined by the diastase method. Soluble carbohydrates means such as are soluble in 10 per cent alcohol and reduce Fehling's solution after hydrolysis. It was found that the maximum reducing power of these soluble carbohydrates was reached after 30 minutes hydrolysis; thereafter reducing power diminished due probably to the destruction of levulose. Direct reducing sugars were also determined.

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[1] Conn. Exp. Sta., Bull. 200, p. 154.

[2] These analyses by Mr. Shepard were made in collaboration with Dr. C. F. Korstian in his study of changes taking place during the germination of acorns. The results are discussed in a paper by Dr. Korstian for publication elsewhere.

TABLE VIII. ANALYSES OF SHELLED ACORNS.

	White Oak Fall Nov. 1925 %	White Oak Spring Apr. 1926 %	Red Oak Fall Nov. 1925 %	Red Oak Spring Apr. 1926 %	Chestnut Oak Fall Nov. 1925 %	Chestnut Oak Spring Apr. 1926 %	Scarlet Oak Fall Nov. 1925 %	Scarlet Oak Spring Apr. 1926 %
In the Fresh Material.								
Water	39.68	36.66	32.90	26.57	47.23	40.70	23.83	31.67
Ash	1.55	1.54	1.76	2.11	1.19	1.75	1.57	1.70
Protein (N x 6.25)	4.48	4.93	4.80	5.06	4.49	5.27	5.90	5.10
Fiber	1.06	1.59	1.59	2.06	1.31	1.84	1.73	1.70
Carbohydrates:								
Starch	28.91	32.49	16.02	23.45	16.99	21.43	18.48	18.24
Soluble, as dextrose after hydrolysis 30 mins.	6.31 (4.83)[1]	5.95 (5.58)[1]	7.09 (4.30)[1]	4.60 (4.02)[1]	7.83 (7.07)[1]	7.71 (7.28)[1]	7.16 (4.05)[1]	4.48 (3.80)[1]
Undetermined	13.90	15.17	20.75	21.39	18.55	20.19	17.85	21.35
Fat	4.11	1.67	15.09	14.76	2.41	1.11	23.48	15.76
In the Water-free Material.								
Ash	2.56	2.43	2.62	2.87	2.26	2.96	2.06	2.48
Protein	7.42	7.79	7.16	6.90	8.50	8.88	7.75	7.46
Fiber	1.77	2.51	2.37	2.81	2.48	3.11	2.28	2.49
Carbohydrates:								
Starch	47.93	51.27	23.89	31.94	32.20	36.14	24.26	26.69
Soluble, as dextrose after hydrolysis 30 mins.	10.47 (8.01)[1]	9.39 (8.80)[1]	10.58 (6.41)[1]	6.26 (5.47)[1]	14.83 (13.40)[1]	13.00 (12.27)[1]	9.41 (5.32)[1]	6.56 (5.56)[1]
Undetermined	23.04	23.97	30.88	29.12	35.16	34.04	23.41	31.27
Fat	6.81	2.64	22.50	20.10	4.57	1.87	30.83	23.05

[1] Direct Reduction.

II. DRUGS.

Solution of Arsenous and Mercuric Iodide.

This preparation should contain in each 100 cc. not less than 0.95 gm. nor more than 1.05 gms. of arsenous iodide and not less than 0.95 gm. nor more than 1.05 gms. of mercuric iodide.[1]

Table IX. Analyses of Arsenous-Mercuric Iodide.

No.	Dealer	Arsenous iodide (AsI_3) gm/100 cc.	Total arsenic as arsenous iodide (AsI_3) gm/100 cc.	Mercuric iodide (HgI_2) gm/100 cc.
34490	Lee & Osgood, Norwich ...... (own make)	0.48	0.96	0.69
34681	Wilson Drug Co., Willimantic (Lehn & Fink, N. Y.)	0.03	1.00	0.78

In both of these samples the arsenous iodide has largely oxidized to the pentiodide form. The rapid transformation of arsenic through oxidation in the case of this product has been pointed out.[2] Total arsenic calculated as triiodide is within the limits of the standard. Mercuric iodide was below the standard, however.

Spirit of Camphor.

Spirit of camphor contains not less than 9.5 gms. and not more than 10.5 gms. of camphor per 100 cc.[3]

Thirty-one samples were examined for the Dairy and Food Commissioner. Of this number only one varied from the standard by more than 10 per cent. This was sold by Barron's Drug Store, New Haven, and contained only 5 per cent of camphor, approximately ½ strength.

Analyses are given in Table X.

Table X. Analyses of Spirit of Camphor.

No.	Dealer	Manufacturer	Camphor, gms/100 cc.
	Branford		
34685	The Spaulding Co.	Own make	10.4
	Bristol		
34654	Bristol Pharmacy	Own make	9.2
34652	Holley Pharmacy	Own make	9.4
34655	Rickman's Drug Store..	Mass. Wholesale Drug Co., Springfield, Mass.	11.0
34653	Leroy P. Tucker	Eastern Drug Co., Boston, Mass.	9.7
	Cromwell		
34666	Hitchcock's Pharmacy..	Own make	9.6

[1] U. S. P. X, p. 208.
[2] Jour. Am. Pharm. Assoc., 15, 464, 1926.
[3] U. S. P. X, p. 351.

TABLE X. ANALYSES OF SPIRIT OF CAMPHOR. *Concluded.*

No.	Dealer	Manufacturer	Camphor, gms/100 cc.
	East Portchester		
34766	D. H. McHugh	Own make	8.7
	Forestville		
34659	Kent's Pharmacy	Brewer & Co., Springfield, Mass.	10.0
	Hartford		
34499	Jefferson Pharmacy	Own make	8.5
34496	Thomas A. Lynch	Sisson Drug Co., Hartford	10.4
	Manchester		
34693	Edward J. Murphy	Own make	9.1
	Meriden		
34673	N. P. Forcier	Own make	9.8
34668	The Graeber Pharmacy		10.0
34670	Lynch Drug Co., Inc.	Own make	10.4
	Middletown		
34663	Geo. R. Cassidy	Own make	9.8
34665	John J. Cronin	Own make	10.6
34664	Lincoln Drug Store	United Drug Co., Boston, Mass.	9.9
	New Haven		
34763	Barron's Drug Store	Own make	5.0
	Plainville		
34661	Geo. R. Byington	Own make	8.8
34660	Thrall's Drug Store	Own make	11.2
	Portland		
34662	Conklin's Pharmacy	Own make	10.6
	So. Manchester		
34692	Miner's Pharmacy		9.7
	Terryville		
34656	Pelchar's Pharmacy	Own make	10.0
34658	Pelchar's Pharmacy		10.3
	Waterbury		
34760	Carroll Co.	Wolf-Thornen, Inc., N. Y.	10.4
	West Haven		
34764	John K. Stevenson	Hance Bros. & White, Philadelphia, Pa.	10.4
	Wethersfield		
34675	Wethersfield Pharmacy	Own make	10.4
	Willimantic		
34680	Bay State Drug Co.	Own make	10.2
34679	Wilson's Windham Pharmacy	Own make	10.5
	Winsted.		
34677	Bannon's Drug Store	Eastern Drug Co., Boston, Mass.	9.8
34678	Frank S. Bunnell		9.6

Camphor Liniment.

This preparation should contain not less than 19 per cent nor more than 21 per cent of camphor.[1]

Twenty-eight samples were examined. Five were found deficient in camphor, and one was misbranded. Sample **34672** was not camphor liniment but double strength spirit of camphor.

Analyses are given in Table XI.

Table XI. Analyses of Camphor Liniment.

No.	Dealer	Manufacturer	Camphor, per cent
	Ansonia		
34479	McArog's Pharmacy ...	Upjohn Co., Kalamazoo, Mich.	19.2
	Branford		
34684	Branford Pharmacy	C. S. Leete, New Haven ...	16.9
	Canaan		
34474	Farnum's Drug Store ..	Lehn & Fink, N. Y.	18.7
	East Portchester		
34765	D. H. McHugh	Filborn Pharmical Co., Brooklyn, N. Y.	20.9
	Falls Village		
34477	G. E. Frink	Brewer & Co., Worcester, Mass.	19.4
	Hartford		
34650	Jefferson Pharmacy	The Bronx Drug Co., N. Y.	19.6
34497	*Thos. A. Lynch*	*J. Russell White, Staten* Island, N. Y.	7.6
	Meriden		
34671	W. W. Mosher	The DePree Co., Holland, Mich.	19.1
34674	Palace Pharmacy	Own make	21.7
34672	Charles H. Pinks	Own make	19.5
	New Britain		
34487	Connor's Drug Store ...	Girard & Co., Inc., Mt. Vernon, N. Y.	18.9
	New Haven		
34686	Baker & Meade, Inc. ...	Own make	19.2
34687	Taft Pharmacy	Own make	20.9
	North Haven		
34469	North Haven Pharmacy	C. W. Whittlesey, New Haven	18.4
	Norfolk		
34471	Geo. T. Johnson Drug Co.	United Drug Co., Boston, Mass.	*22.1*
	Norwich		
34489	Dunn's Pharmacy	Eastern Drug Co., Boston, Mass.	19.6
34492	The Lee & Osgood Co.	Own make	21.0
34491	C. C. Treat	Hance Bros. & White, Philadelphia, Pa.	19.4
	Putnam		
34758	Joseph H. P. Gague	Own make	29.5

[1] U. S. P. X, p. 204.

TABLE XI. ANALYSES OF CAMPHOR LINIMENT. *Concluded.*

No.	Dealer	Manufacturer	Camphor, per cent
	Sharon		
34476	C. H. Egglestone	Gibson Snow Co., Albany, N. Y.	18.7
	South Manchester		
34691	Magnell Drug Co.	Own make	19.1
	Terryville		
34657	Pelchar's Pharmacy	Own make	18.9
	Waterbury		
34761	Carroll Co.	Standard Drug Co., Newark, N. J.	18.2
34759	The Leavenworth & Dikeman Co.	Own make	15.3
34762	Waterbury Drug Co. ...	Own make	20.5
	Willimantic		
34683	Curran & Flynn	Geo. L. Claflen Co., Providence, R. I.	5.6
34682	J. J. Hickey Drug Co. ..	Own make	19.2
	Winsted		
34676	*Opera House Pharmacy*	*Own make ....*	*6.6*

DICHLORAMINE, ETC.

Dichloramine should yield not less than 28 per cent nor more than 30 per cent of active chlorine.[1]

Two samples were examined and found to be of standard strength. One, **34466**, was made by the Abbott Laboratories, *Chicago, and contained 29.82 per cent active chlorine;* the other, **34468**, made by E. R. Squibb & Sons, New York, contained 29.85 per cent.

Chloramine is a similar product containing less active chlorine. It should contain not less than 11.5 per cent and not more than 13 per cent of active chlorine.[2]

Two products made by the Abbott Laboratories were analyzed. One, **34467**, called Chlorazene, contained 11.72 per cent of active chlorine. The other, **34473**, was in tablet form, each tablet declared to contain 4.6 grains of chloramine, and 4.4 grains were found.

A sample of solution of chlorinated soda (Labarraque's Solution), **34488**, was found to contain the required amount of active chlorine, i. e., not less than 2.5 per cent.[3] It was made by Powers-Weightman & Rosengarten.

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[1] U. S. P. X, p. 125.
[2] U. S. P. X, p. 105.
[3] U. S. P. X, p. 224.

Solution of Formaldehyde.

Solution of formaldehyde should contain not less than 37 per cent of formaldehyde.[1] Eight samples were examined and only one was found to be less than 90 per cent of the standard.

Analyses are given in Table XII.

Table XII. Analyses of Solution of Formaldehyde.

No.	Dealer	Manufacturer	Formaldehyde, per cent
	Hartford		
34498	Thos. A. Lynch	Mallinckrodt Chem. Co., N. Y.	36.6
	New Britain		
34486	Novecko Drug Store	Powers-Weightman & Rosengarten, Phila., Pa.	36.7
	North Haven		
34470	North Haven Pharmacy	Merck's, N. Y.	36.8
	Norfolk		
34472	Geo. T. Johnson Drug Co.	Sisson Drug Co., Hartford	32.9
	Norwich		
34493	The Lee & Osgood Co.	Hayden Chemical Co., Garfield, N. J.	36.5
	Sharon		
34475	C. H. Egglestone	....	36.7
	South Norwalk		
34495	Plaisted Drug Store	Dolge Chemical Co., Westport	35.8
	Waterbury		
34478	West Side Pharmacy	Apothecaries Hall Co., Waterbury	36.8

Solution of Magnesium Citrate.

The standard for this article requires that it contain not less than 1.5 gm. of magnesium oxide per 100 cc.[2]

Three samples were examined. One, **34494**, purchased of E. F. Cornell, West Haven, was found to conform to this standard. It contained, however, somewhat less citric acid than the U. S. P. formula calls for.

Another sample, **33860**, made by the Atlantic Druggist Specialty Co., New Haven, contained less magnesium than the official preparation contains; and the magnesium was present partly as sulphate and the remainder as citrate. It was sold under a declaration that it was "not U. S. P." and is not, therefore, illegal.

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[1] U. S. P. X, p. 215.
[2] U. S. P. X, p. 218.

Analysis: Magnesium oxide, gm./100 cc., 0.94; sulphur trioxide 0.94; total citric acid 2.00. Calculated as magnesium sulphate, 1.4; magnesium citrate 1.9.

A sample, **4848**, submitted by a purchaser contained 1.42 per cent of magnesium oxide.

Solution of Potassium Iodide.

To check the accuracy of a determiuation of potassium iodide made on a sample of this drug taken in our 1925 inspection, the third part of our sample **32605**, which was left with the dealer at the time of sampling, was assayed eight months later. It was found to contain 35.6 gms. of potassium iodide per 100 cc. as compared with checked results of 34.9 gms. at the time of preparation and sampling. The third part of this sample had concentrated somewhat due to loss of water during the eight months interval. This preparation should have contained, according to the prescription presented, not less than 45.5 gms. of potassium iodide per 100 cc.

Sample **4693**, McQuade's Drug Store, Ansonia, made and submitted by the dealer, contained 45.1 gms. potassium iodide per 100 cc. According to the formula used the preparation should contain 45.5 gms. assuming 99 per cent purity for the salt.

Tablets (Hypodermic).

34667. *Atropine sulphate tablets.* 1/150 grain. Sold by the Sisson Drug Co., Hartford, manufactured by the Eli Lilly Co. Should contain 0.0067 grains per tablet; found 0.006. The variation is a little wider from the claim than is tentatively accepted (9.0 per cent) for hypodermic tablets of this type and dosage, but the tablets were passed.

34669. *Strychnine sulphate tablets,* (1/30 grain). Sold by Lynch Drug Co., Inc., Meriden, manufactured by Sharp and Dohme. Should contain 0.033 grains per tablet; found 0.019. Tablets were low in strychnine sulphate.

Proprietary Remedies, etc.

Six preparations of this type were examined.

3350. *Ocean-O.* Oceano Products Co., Newark, N. J. This is a liquid preparation made from sea water by removing the common salt and concentrating the other mineral constituents. According to accompanying literature the product is "a scientific, concentrated extract consisting of the natural and vital elements from pure deep sea water."

Analysis, gms/100 cc.: Solids 21.6; ash 13.3; chlorine 9.41 sulphur trioxide 1.9; iodine trace (.0005); carbon dioxide, free 0.049; bicar-

bonate (as HCO_3), 0.018; silica (SiO_2), 0.001; iron and aluminum (as metal), 0.001; calcium (Ca), 0.04; *strontium* (Sr), *none found*; magnesium (Mg), 1.78; sodium (Na), 3.13; potassium (K), 0.53; lithium ?.

There was no evidence of organic material and the difference between the solids and ash is probably due chiefly to water of crystallization and partly to decomposition of magnesium salts. The above analysis agrees substantially with one given in advertising literature.

3836. *Histolo Therapy Inorganic Food Celloids.* Kali Mur. Made by Luyties Pharmacal Co., St. Louis. Three tablets were examined for the State Commissioner of Health.

The average weight of tablets was 4.1 grains each. They consisted of about 98 per cent milk sugar, a small amount (0.13 per cent) of mineral substance (ash), and the balance was largely or entirely moisture. The ash consisted chiefly of chlorides, potassium chloride being found in the amount of 3/100 of one per cent. The name "Kali Mur" means, or suggests, potassium muriate which is potassium chloride. A considerable part of the ash no doubt was derived from the lactose used as an excipient.

3508. *McCoy's Rinolin Emulsion.* Made by McCoy's Rinolin Co., Inc., 62 West 14th St., New York. The label indicates that this preparation is a mixture of mineral oil, agar-agar, phenolphthalein and cascarin.

The preparation contained about 40 per cent of water, 45 per cent of mineral oil and one per cent of phenolphthalein. No evidence of oxymethyl-anthraquinone derivatives was obtained. Agar or some other emulsifying agent is present. "Cascarin" is a name suggested for a hypothetical active principle of cascara which it has been shown[1] is not a definite chemical substance but a mixture of constituents of cascara.

3507. *Matamel.* The concentrated sap of the Mexican Maguey plant (also known as Agave, and American Aloe). Prepared by Philip Newton, M.D., Ometusco, Mexico. Advertising literature indicates that the preparation relieves bladder weaknesses.

Analysis: Solids at 60° C. (in vacuuo) 72.6 per cent; ash 2.0 per cent; invert sugar 19.4 per cent; sucrose 44.7 per cent; total nitrogen 0.27 per cent; gums, pectin, etc., (precipitated by alcohol), 0.36 per cent; acidity, as malic acid, 1.0 per cent.

Michand and Tristan[2] reported an inactive sugar in Agave Americana which they called "agavose." Stone and Lotz,[3] however, have claimed that this sugar is only sucrose. No references

[1] Welcome Research Laboratories, Report 47, 1904.
[2] Am. Chem. Jour., 14, 548, 1892.
[3] Ibid., 17, 368, 1895.

to the medicinal use of Maguey were found except that the fresh juice is said to be laxative, diuretic and amenagogue, and in doses of 2 fluid ozs., useful in scurvy.[1]

33987. A sample of *Asthma remedy* labeled as made by the Frontier Co., Buffalo, was submitted by a nurse. It was found to contain ammonia, iodides and caffeine; arsenic was not determined. A product made by a company of the same name was examined in the laboratory of the American Medical Association[2] and found to contain a mixture of ammonium sodium and potassium iodides, arsenic and caffeine.

3227. *Ibosan.* The Ibosan Agency, 3616 Lyndale Ave., So. Minneapolis, Minn. Accompanying literature says in part: It (Ibosan) is a tried and proven remedy for diabetes. It acts by breaking up the molecules of carbohydrates (sugar and sugar-making foods), and by creating what might be called sugar-tolerance in the organs which have to do with converting carbohydrates into food.

Partial analysis:

A powdered or granulated product which, on treating with hot water, has the odor of yeast.

Moisture 5.93 per cent; total nitrogen 6.75 per cent; ash 8.02 per cent; phosphoric acid (P_2O_5), 3.34 per cent; potassium oxide 3.19 per cent.

Enzymic action on starch slight or negligible.

Inverting action on sucrose marked.

Fermenting powder (zymase) not tested.

The chief effect of the powder, so far as carbohydrate metabolism is concerned, is to convert sucrose into simpler sugars, dextrose and levulose. The difficulty of the diabetic patient is not to convert sucrose, but to metabolize properly the simpler sugars, so that Ibosan offers no real aid to carbohydrate tolerance.

Miscellaneous Materials Examined for Poisons, etc.

Thirty-three samples have been examined chiefly for health officers or other public officials. This work is summarized as follows:

No.	Material	Remarks
33283	*Cooked Carrots.*	A green mold evidently led to the suspicion of Paris green. No poisonous metals were found.
4010	*Fish Lure.*	Sample too small for analysis. Chief noticeable characteristic was the odor which resembled that of anise. Fed to gold fish for two weeks and no unfavorable symptoms noted.

[1] U. S. Dispensatory, p. 1232.

[2] Am. Med. Assoc., Laboratory Report for 1916, p. 114.

No.	Material	Remarks
4201	*Linseed oil.*	Met the requirements of the U. S. P.
5221	*Liquid for cleaning bowling alleys.*	Alleged to have caused dizziness, headache, nausea and other symptoms in those working with it. Liquid found to consist of, or contain, varnish in a solution of carbon disulphide and carbon tetrachloride, the disulphide predominating. Both of these substances are toxic, causing symptoms as described above.
33877 33878 33879 33880 33881	*Materials for identification or to be tested for poison.*	33877 was identified as sodium bicarbonate. 33878 was cake. Fed to white rats for eight days and no unfavorable symptoms noted. 33879, baking powder, not in original container, found to contain 150 parts per million of arsenic. Baking powder does not ordinarily contain arsenic to the extent of more than 1 part per million. 33880 and 33881, sugar and salt. No poisons were found.
31799	*Meat.*	Alleged to have caused death of dogs. No evidence of arsenic, mercury or other metallic poisons, or of cyanide or alkaloids was found.
32844 32845 32846	*Medicines.*	32844. Digitalis capsules containing 1.5 grains of digitalis powder. These tablets are standardized in terms of so-called "cat-units" which involves a biological test. Capsules not assayed but they were made by a reliable firm. 32845. Prescription, theobromine and sodium salicylate. Contained 42.5% theobromine and the equivalent of 30.9% salicylic acid, which were substantially the amounts demanded. 32846. Hexamethylenetetramine tablets found to be of the strength called for by the prescription.
4767	*Medicine.*	No evidence of morphine or of other opium alkaloids found.
5358	*Medicine.*	Iron and ammonia sugar present. Solids had odor of vinegar. Probably iron and ammonium acetate.
4171	*Metal Polish.*	Flash point determined 66° F., open cup method.
4940	*Orange Soda.*	No evidence of poisons detected.
3363 3365 3368	*Stomach contents of dogs; also chopped meat.*	Strychnine identified by chemical and biological tests, both in stomach contents and in meat which had been fed to the animals.
3370	*Stomach of dog.*	No phosphorus (yellow), or other volatile poisons, no alkaloids, and no poisonous metals were detected.
4771	*Stomach, liver and kidney of dog.*	Bismuth and mercury were found but these substances were present in medicine administered to dog. No evidence of other poisonous substances was found.

No.	Material	Remarks
5794	*Stomach of fox.*	The material was preserved with formalin so that tests for cyanides could not be made. A substance was isolated which was probably strychnine but tests for identity were not conclusive.
4995	*Tablets.*	No morphine or other opium alkaloids detected.
3892	*Tablets used for gauging the strength of alkali.*	Tablets composed of potassium hydrogen sulphate, brown-phenol purple and a siliceous excipient. Each tablet contains about 0.34 gm. of potassium hydrogen sulphate which will neutralize 1/10 gm. of sodium hydroxide.
4892	*Unknown waxy material.*	Not positively identified.
5680	*Vaseline.*	No evidence of alkaloids found.
5361	*Water from spring.*	Contained particles of fat floating on surface. No evidence of strychnine, arsenic or cyanide found in the fat or in the water.
4927	*Water.*	No poisonous metals detected.
4895, 4896	*Water, well.*	No evidence of arsenic was found.
4998	*White powder.*	Identified as calcium carbonate. Arsenic test negative.
4772	*Worm capsules for dogs.*	Kamala; areca nut, santonin, chenopodium were tested for but not detected. Oil of savin was not identified but an oil having the odor of savin was present.

Examinations Made for the State Water Commission.

Coöperating with the State Water Commission, five samples of factory waste liquors, etc., have been examined and reported to Mr. Copeland, engineer to the Commission. This work is in accordance with the statute creating the commission which directs that this Station may be called upon for such analytical service as it can render. Analyses required in considerable detail were made by Mr. Fisher. Methods of the American Public Health Association were employed whenever applicable.

Glassware Used in the Babcock Test.

Under the statute requiring this Station to check the calibration of pipettes and test bottles used in operating the Babcock test, the following pieces of glassware have been tested.

	Broken (in transit)	Accurate	Inaccurate or not meeting requirements	Total
Pipettes 17.6 cc.	1	379	0	380
Milk test bottles	22	1745	47	1814
Cream test bottles ...	0	224	17	241
Totals	23	2348	64	2435

In addition 12 lactometers have been checked against our standard instrument.

BULLETIN 288 JUNE, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

The Biology of

THE BIRCH LEAF SKELETONIZER

Bucculatrix canadensisella, Chambers

ROGER B. FRIEND

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The Biology of

THE BIRCH LEAF SKELETONIZER*

Bucculatrix canadensisella, Chambers

ROGER B. FRIEND

I. INTRODUCTION

The biology of *Bucculatrix canadensisella*, or, as it is more commonly called, the birch leaf skeletonizer, is known to only a very slight extent. Not only does the insect have peculiar habits and a specific structure, but its great abundance during certain years, coupled with its habit of feeding on native birches, renders it of interest economically as well as biologically. In the following pages are the results of investigations, made during the years 1924, 1925, and 1926, into its habits, reactions, distribution, history, and morphology. The work is not complete, but it is intended that the gaps shall be filled, in part at least, in the future.

I am indebted to Professor Alexander Petrunkevitch of Yale University and Dr. W. E. Britton of the Connecticut Agricultural Experiment Station for criticism of the work; to Professor G. C. Crampton of the Massachusetts Agricultural College for assistance in certain details of the morphological part; to Messrs. A. B. Gahan, R. A. Cushman, and C. F. W. Muesebeck of the United States Department of Agriculture for determining the species of parasites; to Dr. Annette F. Braun of the University of Cincinnati for some notes on the geographical distribution; to Mr. C. B. Hutchings of the Entomological Branch, Canada, for the use of an unpublished manuscript, and to Mr. B. H. Walden of the Connecticut Agricultural Experiment Station for the photographic work.

II. HISTORY

The earliest reference to the genus *Bucculatrix* is found in the first volume of de Geer's "Mémoires," in which is given the life history of a "little caterpillar with sixteen legs, smooth, green, which feeds on the lower side of the leaves of Frangula." It was the manner in which this caterpillar spun its cocoon which attracted the attention of de Geer, as the following extract from his

* This paper is a dissertation presented in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Yale University.

"Mémoires" shows: "Quand elles sont parvenues à leur juste grandeur, ce qui arrive dans le mois susdit, elles filent contre les feuilles mêmes de trés-jolies petites coques alongées qui meritent extrèmement d'ètre connues, à cause de leur figure particulière. Ce sont ces coques qui m'ont déterminé à donner l'histoire de ces Chenilles." He gives a detailed description of the manner in which the cocoon is woven, and also gives brief attention to the pupal and adult stages. There is a plate of illustrations of the larva, the structure of the cocoon, the adult, and the injury to the plant. The species described was *Bucculatrix frangulella* and the host plant, *Rhamnus frangula*, the buckthorn.

In 1832 de Haan published a posthumous volume of Lyonet's works in which there is a description of a "chenille extrèmement petite, mais qui emploie une adresse inconcevable à se filer une coque cannelée." This description formed part of a letter from Lyonet to Réaumur written December 22, 1744, and was later sent to the president of the Royal Society of London to be published if the society saw fit to do so. Most of the description is devoted to the details of the structure and weaving of the cocoon. In his illustrations Lyonet figures the larva, cocoon and its structure, and adult. The larvae were found by Lyonet on the leaves of the oak. This species was *Bucculatrix ulmella* Mann (Zeller).

The history of the genus up to 1862 is given by Stainton in his "Natural History of the Tineina." Linnaeus and Fabricius neglected it entirely, and in 1783 Goeze, in his "Entomologische Beiträge," gave the name *Tinea frangulella* to de Geer's species. Neither de Geer nor Lyonet gave names to the species they described. Retzius, writing contemporaneously with Goeze, and Villers six years later, both gave different names to the *Tinea frangulella* of Goeze. The next person after de Geer to describe a species of this genus was Haworth, who in 1829 in "Lepidoptera Britannica" described *Tinea cuculipenella* with the varieties *beta*, *gamma*, and *delta*. Stainton notes that although Haworth's descriptions are very vague, *beta* was probably *Bucculatrix boyerella*, *gamma*, *B. crataegi*, and *delta*, *B. ulmella* (Lyonet's species). Three years later, in 1832, appeared the posthumous volume of Lyonet's works, in which is described what proved to be *Bucculatrix ulmella*, as mentioned above. In 1834 Stephens translated Haworth's description of *Tinea cuculipenella* without mentioning the varieties *gamma* and *delta*. In 1833 Treitschke had redescribed de Geer's species as *Elachista rhamnifoliella*, and a new species, *Elachista gnaphaliella*. In 1838 Duponchel figured four species in his "Lepidoptères de France," in the genus *Elachista*, namely, *E. boyerella*, *E. rhamnifoliella*, *E. gnaphaliella*, and *E. hippocastanella*. In 1839 Zeller, in "Isis," placed the following species in section A of his genus *Lyonetia*: *L. rhamnifoliella* (giving reference to de Geer), *L. albedinella* (*boyerella* of Duponchel),

L. hippocastani (*hippocastanella* of Duponchel), *L. cristatella, L. nigricomella, L. cidarella,* and *L. crataegi.*

In 1848 Zeller established the genus *Bucculatrix* with nine species, the descriptions appearing in "Linnaea Entomologica," volume III. The nine species, with the authors credited by Zeller, were:

1. *Bucculatrix cidarella* Tischer
2. *ulmella* Mann
3. *crataegi* Zeller
4. *boyerella* Duponchel
5. *gnaphaliella* Treitschke
6. *frangulella* Goeze
7. *hippocastanella* Duponchel
8. *nigricomella* Zeller
9. *cristatella* F. R.

The species *gnaphaliella* had been previously (1839) placed by Zeller in *Lithocolletis.* He included *Bucculatrix* in a group of leaf-mining moths possessing eye-caps. Much of the history of the genus from Zeller on does not concern us here and will be omitted. Stainton, from whose work much of the above information has been derived, listed in 1862 nineteen species of *Bucculatrix* of which he considered fourteen good and five doubtful. The fourteen were known in the larval form and their food plants were given. Twelve of the fourteen are described by Stainton very fully. This work covers practically all that was known of the genns up to the time of writing.

For the earliest described American species we must turn to the writings of Clemens, who, in the Proceedings of the Academy of Natural Sciences, Philadelphia, for 1860, published the descriptions of four new species of *Bucculatrix: B. coronatella, B. pomifoliella, B. agnella,* and *B. trifasciella.* These descriptions were again published in 1872 in a posthumous volume of the writings of Clemens, edited by Stainton. This volume also includes a description of the genus by Clemens. Chambers, in the Canadian Entomologist, volume V, 1873, described and mentioned nine American species of this genus and stated these to be all the described American species known to him. These nine are: *B. trifasciella* Clemens, *B. capitealbella* n. sp., *B. pomifoliella* Clemens, *B. obscurofasciella* n. sp. (possibly synonymous with *B. coronatella* Clemens), *B. luteella* n. sp., *B. agnella* Clemens, *B. packardella* n. sp., *B. coronatella* Clemens, *B. thuiella* Packard. Although Chambers considered his *obscurofasciella* possibly synonymous with *coronatella* Clemens, Forbes (1923) gives *trifasciella* Clemens and *obscurofasciella* Chambers synonymous with *packardella* Chambers. It is not proposed to give a discussion of systematics and synonymy here, however. This briefly concludes the history

of the genus in America up to 1875, when the species *canadensisella* was described.

In the Canadian Entomologist, volume VII, 1875, Chambers described *Bucculatrix canadensisella,* having received his specimen from Canada. This description (see page 401) concerns the adult only and does not mention the larva nor the larval food plants. *B. cidarella* of Europe Chambers considered close to *B. canadensisella,* although quite distinct. The larva of the European species *demaryella* feeds on birch, but according to the description given by Stainton (1862) it also is quite distinct from *canadensisella.*

For twelve years after the description by Chambers there occurs no mention of the species, but in 1887 Lintner recorded the occurrence of the insect in Monroe County, New York, where the larvae were very abundant on the leaves of *Betula lutea* during the fall of 1886. In 1890 Packard recorded what was in all probability this species on the leaves of the white birch at Brunswick. Maine. Lintner again reported it from New York in 1893, this time as injurious to all the native birches in the region of Ausable Forks during September, 1891. The same year Fletcher stated that all the birches around Ottawa, especially *Betula papyrifera, B. lutea,* and *B. alba* (European white birch) were severely injured. From this time on the reports of the insect become more frequent and the injury caused by its larvae more noticed. Hutchings published a brief life history in the 56th Annual Report of the Entomological Society of Ontario (1926), and this treats of the insect more fully than any other publication to date. The species is of some economic importance, and most of the literature on it concerns the injury done to the birch trees.

Systematically the genus has been neglected, and when mentioned it is referred to as aberrant. Forbes (1923) published a key to the species found in northeastern United States with descriptions. For descriptions of species discovered in the present century in America the writings of E. Meyrick, A. F. Braun, and A. Busck should be consulted; and for Old World species see the writings of E. Meyrick, especially his "Exotic Microlepidoptera."

The history of the insect is interesting in view of the fact that at frequent intervals it appears in extraordinary numbers and severely attacks birches over wide areas. In 1886 Lintner found it abundant in Monroe County, New York, and in 1887 it was reported as abundant in Massachusetts. During the years 1890, 1891, and 1892 a serious outbreak occurred in Ontario, New York, and New England. In 1901, 1902, and 1903 it was again very abundant and severely attacked birches throughout this same area. In 1907 a small outbreak occurred on Staten Island, New York, and in 1910 the insect was abundant at Kinderhook, New York.

In 1909 and 1910 birches in Minnesota were extensively skeletonized, and the insect's depredations were severe in Ontario in 1910, 1911, and 1912, and in New England in 1909, 1910, and 1911, growing less serious in 1912 and 1913. The third outbreak of this insect thus covered Ontario, Minnesota, and New England between 1909 and 1912, with small outbreaks in New York in 1907 and 1910. In 1919 the larvae were again beginning to appear in large numbers. This year they were abundant in New Brunswick and were noticed in Connecticut. In 1920 birches were heavily skeletonized and defoliated in Ontario, Quebec, and New Brunswick. In 1921 the infestation continued in these regions, and larvae were abundant in Minnesota and appeared commonly in Massachusetts. In 1922 the injury to birch trees was conspicuous over the Great Lakes region and in New England. This last outbreak began to subside in 1924, although the larvae were injurious in Quebec in 1925. Beginning about 1890 there have been four serious outbreaks of this insect, one about every ten years. Some of the possible reasons for this periodic abundance will be considered under the section dealing with predaceous and parasitic enemies.

III. Systematic Position

The genus *Bucculatrix* was placed by Zeller in a group of minute leaf-mining moths the adult antennae of which possessed eye-caps. Along with *Bucculatrix* were *Lyonetia, Cemiostoma, Nepticula,* etc. The first general treatise on *Bucculatrix* placed the genus in the Tineina (Stainton 1862). It is usually placed in the Lyonetiidae today and is so classified by Forbes (1923). There are, however, differences of opinion as to the classification of Lepidoptera and of this genus in particular. Thus Forbes places *Bucculatrix* in the family Lyonetiidae of the superfamily Tineoidea, but Mosher (1916) places it in the family Bucculatrigidae of the superfamily Gracilarioidea, basing her decision on pupal characters; and Fracker (1915) places it in the family Bucculatrigidae of the Tineoidea. The grouping of families and genera in the Tineina is still apparently an open question. The genus will here be placed in the Lyonetiidae according to the classification of Forbes and considered as slightly aberrant. For a taxonomic account of the genus and a key to the species of northeastern United States the work of this author may be consulted.

IV. Laboratory Methods

The life history data were secured by rearing individual larvae in glass jars or vials, each receptacle containing wet sand and a fresh birch leaf. Observations were made daily. Adults for

oviposition records were caged over a birch twig in a celluloid cylinder with cloth ends. This permitted natural conditions of light and air. The leaves were examined daily with a glass and eggs were marked with a circle of black ink and numbered. Pupae were obtained by simply placing small pieces of heavy cardboard under the plant in a stock rearing cage. The larvae spun their cocoons on the under side of the cardboard. The pupae were kept in a box sunk in the ground until the early summer. Just prior to the period of emergence they were placed singly or in groups of five in glass vials plugged with cotton or in large gelatin capsules, the ends of which were perforated. This made observations on the emergence of adults a simple matter. All life-history studies were made in an out-door insectary. For dissecting fresh material, it was found best to cover the chloroformed specimen with a drop of thick shellac, add one drop of alcohol, allow to set a few minutes, and then immerse in saline solution. The shellac became pitchy and held the insect firmly, but at the same time it could be easily removed from the chitin. For studying the external morphology the insects were boiled in 10 per cent potassium hydroxide until clear and then stained in tetrabromfluorescic acid twenty-four hours. The chitinized plates stained deeply red, and the membranous cuticle a light pink. The body being clear, the internal skeletal structures were readily observed. For the temperature experiments the larvae were kept singly in glass vials or in test tubes, the receptacle in either case being plugged with cotton. The food material was kept fresh and unwilted. The individual insects in all cases were from miscellaneous field collections made in the vicinity of New Haven except where otherwise noted.

V. Morphology

The morphological descriptions will be confined to the external appearance of the various stages and certain important anatomical details of the exoskeleton. The genital organs of the adult will be briefly mentioned as they are of considerable interest morphologically and have more or less influence on the external form. The internal anatomy is not further described here, but it is intended that a description of the anatomy and histology will be produced later.

The original description of the genus by Zeller (1848) is reprinted below.

Bucculatrix Zell.

Elachista Tr. Lyonetia ex p. Zell.

"Caput lanatum, cornosum.
"Antennae breviusculae, conchula basali parvula instructae.
"*Palpi nulli; os squamis epistomii tectum.*

"Alae anteriores caudulatae; cellula discoidales acuta postice venulas 6 emittit; vena subcostalis longissime interrupta; subdorsalis simplex:

"posteriores lanceolatae; vena mediana in 3 ramos divisa, subdorsalis simplex.

"Tibiae posticae pilosae.

"Larva 16 pes supra epidermidem foliorum vivit; metamorphosis in folliculo affixo subit."

The presence of palpi will be brought out later, and the vein which Zeller calls "mediana" in the hind wing is designated in this paper the radius.

The following is the original description of *Bucculatrix canadensisella* by Chambers (1875):

Bucculatrix canadensisella n. sp.

"The ornamentation of this species differs from that of any other yet found in this country, and though allied to *B. cidarella* of Europe, it is still quite distinct.

"Head white. Tuft tipped with dark reddish brown, and the face faintly tinged with purplish fuscous. Upper surface of the thorax brown margined all around with white. Base of the fore wings white, followed by an oblique brown fascia, which is nearest the base on the costal margin, and is followed by an oblique white fascia; all of these are placed before the middle and are followed by a large brown patch which occupies the entire wing to the ciliae, except that it contains a white spot on the middle of the costal margin. The brown patch is margined before on the dorsal margin of the wing by a small tuft of raised brown scales. At the beginning of the dorsal ciliae is a white spot placed a little before, but becomes almost confluent with a longer white costal streak. Behind these streaks to the apex the wing is pale brown, with a darker velvety brown apical spot. Ciliae pale yellowish, with a dark brown hinder marginal line before their middle not extending into the costal ciliae. Hind wings pale fuscous. *Al. ex.* ⅜ inch."

A. Adult

1. External Appearance

As both the above descriptions are rather brief, the external appearance of the adult is here given in a little more detail. By reference to plate XVII and text figure 12 the important markings can be easily followed. Sexual differences are slight and will be referred to in the description.

The general appearance of the adult in repose is shown in plate XVII. The head bears a dorsal tuft of rather long hair-like scales, the center of which is brown and the outer parts white. The "face" is covered with gray or brownish scales. When the insect is at rest the head is bent ventrally so that the labium touches the bases of the prothoracic coxae and the short tongue is curled and concealed between the latter. There are no maxillary palpi, and the labial palpi are very small and concealed beneath the head. The eyes are black and partly concealed by the scapes of the antennae which

are expanded to form eye-caps. These eye-caps are white, and from the anterior border of each there extends down in front of the eyes curved slender scales which give the insect the appearance of having "shaggy brows." The pedicel of the antenna is short, and the flagellum contains 29 segments, each of which bears two whorls of brownish scales. The proximal segments of the

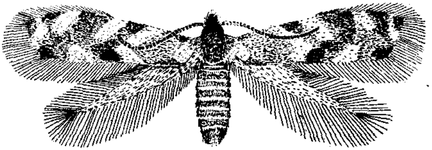

FIG. 12. Adult moth, enlarged about ten diameters.

flagellum have no scales on the ventral side. This "nude" area is usually considered sensory. The first segment of the flagellum (third of antenna) is longer than any of the remaining segments. The antenna is about two-thirds the length of the body and filiform.

The ground color of the fore wings is brown, and although typically reddish, it often varies to a yellowish. The wings are marked with transversely diagonal white bars as shown in figure 12. The basal bar is confluent with a white area on the mesothorax. The second bar forms an angle with the apex directed distally. It sometimes extends completely across the wing and is often interrupted in the center by brown scales. The remaining bars do not cross the wing but terminate near the midline. There are two extending from the costal border and one from the anal border, all three directed slightly apically. Close to the tip of the wing is another white area whose exact size varies somewhat in different individuals. It extends from the costal to the distal border of the wing but does not include the apex, this latter being dark, almost sable, in color. There are two other prominent dark spots on the wing, one at the anal angle and one at the distal margin of the second transverse white bar. Both of these are always present, and sometimes there are other dark spots on the costal border. Beginning slightly distal from the middle of the costal border a row of gray cilia extends around the wing almost to the proximal end of the anal border. The tuft of raised brown scales on the anal border of the wing as described by Chambers is usually conspicuous.

The hind wings are gray and their borders are almost completely ciliated. The superficial difference in shape between the fore and hind wings is due to the more extensive development of scales on the former. The scales on the hind wing are less numerous and do not project beyond the wing borders. Both the wings are really pointed.

The dorsal side of the thorax is brown with white areas laterally, these latter being confluent with the white basal areas on the wings. Each tegula bears a group of eight to ten bristle-like scales which extend along the costal border of the wing as far as the metathorax when the wings are folded. The pleural and sternal sides of the thorax are silvery-white. The coxae are large and of the same general color as the sternum of the thorax except that the lateral borders are brownish, particularly proximally. The femora and tibiae are brown laterally and white medially, as is the first tarsal joint. The tarsal joints two, three, and four each have a white ring proximally and a brown ring distally. The fifth tarsal joint is white, and its scales almost conceal the tarsal claws. At the posterior border of the mesothoracic tibiae at the distal end is a pair of spurs, and a pair of similar spurs is found at each end of the metathoracic tibiae. There is a pair of spines at the distal end of each of the first four tarsal joints. A row of thickly set long hairs is found on the anterior and posterior border of the metathoracic tibiae.

The abdomen is covered with silvery-white scales ventrally and brown scales dorsally. The males have seven segments superficially distinct on the ventral side, the second to the eighth inclusive, and the scales from the eighth practically cover the genitalia. The female has six segments superficially distinct ventrally, the second to the seventh inclusive. Scales from the seventh segment conceal the border between the seventh and eighth, and scales from the latter cover the remainder of the abdomen, giving the appearance of one broad segment. The ninth segment in the female is partly retracted within the eighth, and the tip of the ninth projects very slightly beyond the scales of the latter. The terminal fringe of scales on the male abdomen flares slightly but never does so on the female. The female abdomen is slightly larger than the male. On the dorsal side of the abdomen of each sex there are distinctly demarcated eight segments, the first to eighth inclusive.

The body length averages about three millimeters and the alar expanse seven millimeters. The sexes are of equal size.

2. Head (Text figure 13)

The head is somewhat compressed anterior-posteriorly, and the occipital surface is flat. The antennae are filiform and composed

of 31 joints, of which the first or scape is expanded to form the eye-cap. The second joint or pedicel is short and subspherical. The third joint (first of the flagellum) is half again as long as any of those following. The length of the antennae compared

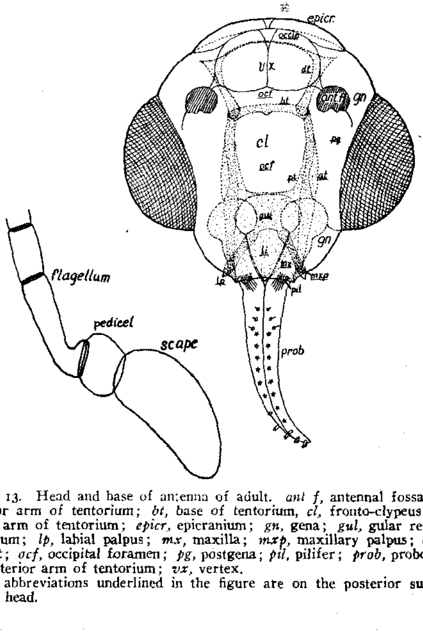

FIG. 13. Head and base of antenna of adult. *ant f*, antennal fossa; *at*, anterior arm of tentorium; *bt*, base of tentorium, *cl*, fronto-clypeus; *dt*, dorsal arm of tentorium; *epicr*, epicranium; *gn*, gena; *gul*, gular region; *li*, labium; *lp*, labial palpus; *mx*, maxilla; *mxp*, maxillary palpus; *occip*, occiput; *ocf*, occipital foramen; *pg*, postgena; *pil*, pilifer; *prob*, proboscis; *pt*, posterior arm of tentorium; *vx*, vertex.

The abbreviations underlined in the figure are on the posterior surface of the head.

with the body length is shown in figure 12. The eyes are black and weakly spherical. There are no ocelli. Between the antennal fossae (ant f) and connecting them is the suture which separates the fronto-clypeus (cl) from the epicranium (epicr). A suture running between the eyes and through the epicranium divides off the vertex (vx) anteriorly. The vertex bears the forward-project-

ing hairs of the dorsal tuft and is divided by a median light suture. The posterior part of the epicranium is likewise divided by a median suture and bears the upward- and backward-projecting hairs of the dorsal tuft. The occiput (occip) lies between the epicranium and occipital foramen and is not sharply demarcated from the postgenae laterally. The fronto-clypeus appears to extend laterally to the eyes. The labrum is not present as a distinct sclerite and is represented by a pair of pilifers (pil) placed one above each maxilla. There are no mandibles. The proboscis (prob) is reduced, being about the length of the head. Each half of the proboscis (the galea) bears on its anterior surface a row of eleven papillate projections which appear pentagonal in cross section and each of which terminates in a short peg. The particular function of these was not ascertained. Near the base of each half of the proboscis and also on the anterior surface are three or four setae. Near the base of each maxilla and projecting from the lateral side is a small protuberance (mxp) which may represent the rudiment of the maxillary palpus. The bases of the maxillae (mx) are, as usual with Lepidoptera, firmly fixed in the ventral (posterior in this case) side of the head. The labium (li) is a small triangular sclerite, with a forward-pointing apex, on the ventral side of the head and lies between the maxillae. It bears a pair of one-jointed palpi (lp). Between the labium and the occipital foramen (ocf) lies a gular region (gul) which is bounded laterally by the maxillae. Its separation from the labium is indistinct. The postgenae are separated dorsally from the genae (gn) by the suture which divides the epicranium and ventrally by the sutures connecting the maxillae with the lower border of the eyes. The genal regions are not distinctly separated from the fronto-clypeus.

The tentorium is similar to that of other Lepidoptera. The body of the tentorium (bt) separates the occipital foramen into a dorsal and ventral part. The anterior arms (at) come forward from the body and then turn ventrally to terminate at the ventro-lateral angles of the fronto-clypeus. The dorsal arms (dt) extend up from the body to the occiput, bordering the foramen laterally. The posterior arms (pt) extend down each side of the lower part of the foramen to the maxillae. In the figure of the head all the abbreviations of the parts on the posterior (morphologically ventral) side of the head are underlined.

3. Cervical Region (Text figure 14)

The head is supported by a pair of laterally placed cervical sclerites (cerv) which extend from the prothorax. At the cephalic end they meet the body of the tentorium, and at the posterior end they articulate with the episterna and then curve medially to meet in the midline.

4. Thorax

The three thoracic segments are distinct, although the prothorax is much reduced. The mesothorax is the most developed, due to the development of the fore wings and the powers of flight. In the following description the nomenclature of Crampton (1909) has been adhered to as far as possible.

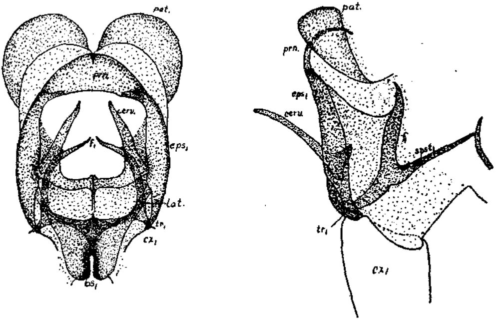

FIG. 14. Prothorax of adult, anterior (left) and lateral (right) aspects. *bs*, basi-sternum; *cerv*, cervical sclerite; *cx_1*, coxa; *eps_1*, episternum; *f_1*, furca; *lat*, precoxal bridge; *pat*, patagium; *prn*, pronotum; *spst*, spinisternum; *tr_1*, trochantin.

a. *Prothorax* (Text figures 14 and 15)

The tergal region of the prothorax consists of a central triangular pronotum (prn) and two laterally placed and conspicuous patagia (pat). The apex of the pronotum meets the prescutum of the mesothorax in the midline.

The pleural region contains one narrow sclerite, the episternum, (eps) which meets the pronotum above and the coxa (cx) below. Anteriorly it supports the cervical sclerites and meets the precoxal bridge (lat) of the sternum. There is a very minute sclerite, the trochantin (tr), at the articulation of the coxa. The epimeron is obsolete. From the posterior border of the episternum the pleural apodeme extends into the body cavity and meets the arms of the furca (f_1). Of the sternal sclerites the basi-sternum (bs_1) is the larger and extends laterally in the precoxal bridge to

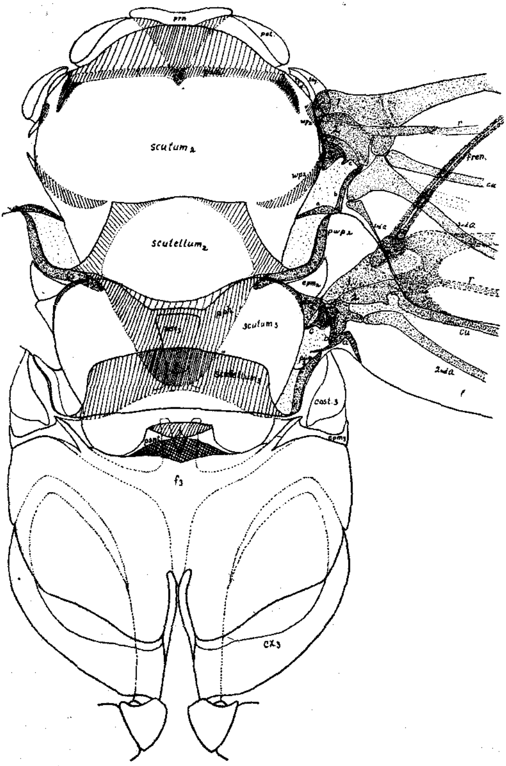

FIG. 15. Thorax of adult, dorsal aspect. *a, b, c,* axillary sclerites; *awp,* anterior wing process; *cost,* costal sclerite; *cu,* cubitus; *cx,* coxa; *epm,* epimeron; *f,* furca; *fren,* frenulum; *msc,* median area of scutum; *pat,* patagium; *pph,* postphragma; *prn,* pronotum; *psc,* prescutum; *psnt,* posterior chitinous plate on metathorax; *r,* radius; *teg,* tegula; *tg pl,* tegular plate; *wp,* wing process; *1, 2,* axillary areas; *2nd a, 3rd a,* anal veins. The inferior numbers indicate the thoracic segment to which the part belongs.

meet the episterna. The median part of the basi-sternum is folded and lightly chitinized, extending slightly down the coxa on each side. The furca-sternum and basi-sternum are not distinctly separated. Caudally from the furca-sternum the narrow spini-sternum ($spst_1$) extends along the ventral midline to meet the presternal sclerite of the mesothorax. What is here called the basi-sternum is apparently the eusternum of other authors. The furca extends up into the body cavity, and from its base a pair of lateral arms extend to meet the base of the episternum on each side.

The prothoracic coxa is not divided into eucoxa and meron, although a faint "suture" extends some distance up from the trochanter along the caudo-lateral surface. The coxa articulates freely with the episternum and trochantin. The trochanter and femur are of the usual type. The tibia bears no spurs. The coxa, femur, and tibia are approximately equal in length, and the tarsus is slightly longer. The basi-tarsus is almost as long as the second and third tarsal joints combined. There are five tarsal joints and each of the first four bears a pair of short spines on the posterior side of the distal end. The tarsus terminates in a pair of claws.

b. *Mesothorax* (Text figures 15 and 16)

The tergal part of the mesothorax consists mainly of two sclerites, the large scutum (sc_2) and the smaller somewhat rhomboidal scutellum (scl_2). The anterior part of the scutum is rolled in, and from its margin is given off the narrow prescutum (psc_2). This has been considered a true sclerite by some authors, but according to Crampton it is simply a phragma. At its midpoint the pronotum is attached. At the anterior lateral angles of the scutum are the large tegulae (teg) and beneath each tegula is a smaller tegular plate (tg pl). On each lateral side of the scutum are two pointed wing processes (wp_2) which project slightly and which continue medially along the under side of the scutum as chitinous thickenings. These processes help support the wing. The scutellum bears along its anterior and lateral margins a phragma which projects slightly into the body cavity. The posterior lateral angles of the scutellum continue out as the anal borders of the wings. From the posterior margin of the scutellum the large postphragma (pph) projects ventro-caudally into the body cavity. This phragma is made up of a layer from the mesoscutellum and one from the metathorax. The layers are easily separated. There is no true postnotum (or pseudonotum) present as a distinct sclerite. The curved process (pwp_2) which supports the anal area of the wing extends out from the lateral

angles of the scutellum. This is called the posterior wing process by Snodgrass (1909).

The pleuron of the mesothorax is largely made up of two sclerites, the epimeron (epm_2) and episternum (eps_2) separated by the vertical pleural suture. The pleural apodeme extends into the body cavity from this suture. The episternum is divided into a dorsal anepisternum ($aneps_2$) and a ventral katepisternum ($keps_2$) separated by a triangular middle area. At its anterior margin the anepisternum rolls in medially. From the dorsal margin of the sclerite the alar process (alp) projects upward and supports the wing, and the tegular arm (tega) extends anteriorly to the anterior lateral angle of the scutum where it abuts against the tegular plate. The tegular arm and alar process together with a ventral projection on the anepisternum appear to form a single anchor-shaped sclerite fused with the latter and separable from it with no great difficulty. The katepisternum meets the sternum ventrally. The epimeron is a single undivided sclerite somewhat membranous dorsally. It meets the posterior wing process and then arches over as a narrow arm to meet the arm of the furca (f_2). Just under the anal area of the wing and dorsal to the epimeron is the somewhat elongate costal sclerite ($cost_2$). There is no distinct trochantin but it may be represented by a triangular area just over the coxa. The pleural apodeme widens at this region and forms a support for the coxa.

The anterior sclerite of the mesosternum (presternum, pst_2) projects forward from the basi-sternum (bs_2) to meet the posterior sclerite of the prothoracic sternum and extends slightly beyond it into the body cavity. This sclerite widens as it meets the basi-sternum. The latter is triangular, its apex being posterior, and is divided by a median longitudinal suture. From this suture and extending into the body cavity is a median chitinous blade (mbl). Posterior to the basi-sternum is the furca-sternum (fs_2) which extends down the medial side of each coxa as a pedal region (pdr_2) and holds the coxa rigidly to the body. The furca (f_2) arises from the furca-sternum and sends from its base a short curved process (fpr_2) into the body cavity anteriorly. The arms of the furca meet the arms of the epimera dorsally. The latero-sternites extend from the basi-sternum laterally to the pleural suture.

The mesothoracic coxa (cx_2) is divided into an anterior eucoxa ($eucx_2$) and a posterior meron (mer_2) by a vertical suture on the outer side. On the medial surface of the coxa lies a heavily chitinized angular plate (cs_2) which meets the pedal region of the furca-sternum. The leg articulates at the trochanter, the coxa being immovable. The tibia bears at its distal end on the posterior side a pair of spurs of which the outer is longer. The tarsus is

similar to that of the prothoracic leg. The mesothoracic leg is slightly longer than that of the prothorax.

The wing venation (figure 17) is much reduced. The subcosta and costa are probably represented by the single costal vein. The radius (r) is rather faint at the base and gives off five branches distally. The median vein has disappeared except for the branches m_1 and m_2. The cubitus (cu) is single. There is a faint fold (1st a) which may represent the first anal vein. The second (2d a) and third (3d a) anals are distinct. There is some variation in the origin of r_4, as it sometimes branches off distally to the position shown in the figure. The costal vein bears a retinaculum (ret) for the frenulum. The veins named above are according to Forbes (1923).

The axial sclerites of the wing are as shown on the right side of figure 15. The sclerites a, b, c, 3, and the small sclerite between 1 and 3 are hard chitinous plates, but those marked 1 and 2 are thickenings of the wing similar to veins. The alar process of the pleuron abuts on 2, as does the anterior of the scutal wing-processes. The posterior of the two scutal wing-processes abuts on 3, and the posterior wing-process supports a. The anal area of the wing folds along the outer border of b.

c. *Metathorax* (Text figures 15 and 16)

The scutum (sc_3) of the metathorax is divided medially by a triangular area (msc_3). This does not appear to be a distinct sclerite but simply a more lightly chitinized region. The post-phragma of the mesoscutellum is attached to the anterior margin of the scutum, its line of attachment extending to the wing process (awp_3) at the anterior lateral angles. The scutellum (scl_3) is a band stretching across the base of the scutum and appears to overlap the latter, due to the presence of a phragma which projects caudo-ventrally into the body cavity. From the posterior border of the scutellum a membrane drops ventrally to meet a chitinous arm which forms a bridge between the ends of the epimera. The center of this bridge bears a chitinous plate (psnt) to which the tergum of the first abdominal segment is attached. This represents the pseudonotum (Snodgrass), although much modified from a primitive condition. At its lateral angles the scutellum continues into a narrow posterior wing process (pwp_3) which supports the anal area of the wing.

The pleuron of the metathorax resembles that of the mesothorax. The trochantin area at the head of the coxa is more distinct here, however. Dorsally the alar process (alp) continues directly with the pleural apodeme, and the anepisternum ($aneps_3$) bears another process which also supports the wing. The costal (cost.) sclerite is prolonged anteriorly as a long arm. The

epimeron (epm_3) extends further posteriorly than does the same sclerite in the mesothorax.

The sternum of the metathorax differs markedly from that of the preceding thoracic segment. From the central basi-sternum (bs_3) extend the narrow latero-sternites (not shown in the diagram). The basi-sternum extends caudo-ventrally to meet the

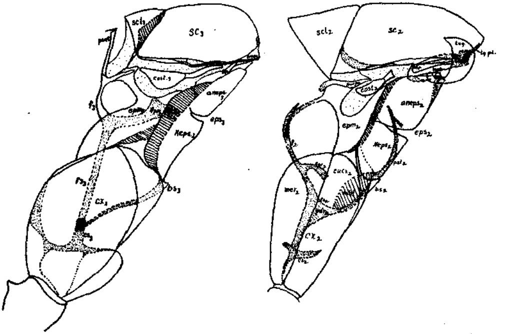

FIG. 16. Meso- (right) and meta- (left) thorax, lateral aspect; *alp*, alar process; *aneps*, anepisternum, *bs*, basi-sternum; *cs*, median coxal support; *eucx*, eucoxa; *fs*, furca-sternum; *fpr*, furcal process; *keps*, katepisternum; *mbl*, median blade; *mer*, meron; *pdr*, pedal region; *tega*, tegular arm; *sc*, scutum; *scl*, scutellum. For other abbreviations see figure 15.

furca-sternum (fs_3) at the coxal support. There is no pedal region of the furca-sternum, but the coxa is held rigidly by this sclerite plus the basi-sternum. The furca-sternum extends as a narrow arm dorsally and then divides into a furca (f_3). The anterior furcal process (fpr_3) is very large and the furca is heavy. Dorso-laterally the arms of the furca meet those of the epimera.

The meron of the coxa is much reduced and occupies a posterior-medial position, only the eucoxa being visible laterally. The tibia bears a pair of spurs on the posterior side of each extremity, and the outer spur of each pair is the longer. The leg is otherwise similar to that of the mesothorax.

The wings (figure 17) show greatly reduced venation. There are, besides the costal, three principal veins, the radius (r), cubitus (cu), and the second anal (2d a), the median being represented

by two branches only. The costal vein probably represents th combined costal and subcostal. The radius is single and from i there branch the two divisions of the median (m_2 and m_3). Th cubitus is single. The frenulum (fren) consists of two stou setae that are held in the retinaculum of the fore wing.

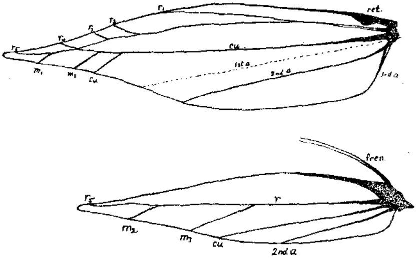

FIG. 17. Fore (above) and hind (below) wings; *1st a, 2nd a, 3rd a,* ana veins; *cu,* cubitus; *fren,* frenulum; *m,* median; $_{1-5}$, radius; *ret,* retinaculum

The axial sclerites of the hind wing are as shown in figure 15. An angular sclerite (a) in the anal region is pivoted on the posterior wing process. The anal region folds along the outer side of this sclerite. Two sclerites (b and c) lie between this and the anterior wing process. These three constitute the chitinous axial plates homologous with those of the fore wing. The areas marked 1 and 2 are thickenings of the wing similar to veins and are homologous to the same areas of the fore wing. The sclerite c may correspond to 3 of the fore wing, and the sclerite b to b and c of the fore wing. The alar processes of the pleuron abut on the area marked 2, and the subcostal area (1) meets the anterior wing process and the sclerite marked c.

Snodgrass (1909) has described the typical arrangement of the axial sclerites in the wing, but the tracing of these in the wing here described is uncertain, due to the difference in arrangement, and hence the letters and numbers as given here do not correspond to those of the above author.

5. Abdomen (Text figures 18 to 20)

The abdomen has nine visible segments in the female and ten in the male, although in the latter sex the tenth is reduced to the socii. The apical segments in each sex are modified to form the

external genital apparatus. The first segment has a strongly chitinized tergum, probably a development in accordance with its function of supporting the abdomen on the thorax. The sternum of the first segment is indistinguishably fused with that of the second and both are quite membranous. The identification of two sterna is furnished by the presence of two spiracles on each side.

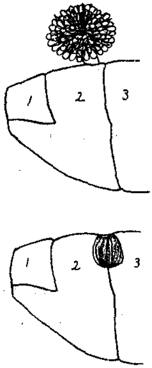

FIG. 18. "Alluring" organ on abdomen of adult male, expanded above, retracted below.

In the female the segments from two to seven inclnsive are of the usual unmodified type, but in the male the second segment shows a peculiar sexual dimorphism. On the caudal margin of the tergum of this segment is located a protrusible organ which, for want of a better name, has been termed an alluring gland. Similar organs called alluring glands have been described as occurring on other parts of male Lepidoptera, and until a histological and cytological investigation is made of this particular case, the common term will be used in describing it. In other species of Lepidoptera there is considerable evidence that these organs give off a distinct odor when protruded, but the alluring function of these in a sexual sense is not definitely proved. This "gland" is shown in figure 18 protruded (above) and retracted within the abdomen (below). When retracted it folds in an eversible sac, and when protruded the entire organ, including the sac, projects out from the body, looking for all the world like a composite flower.

The scales composing it are of two kinds, some pointed and some lobular. This organ is found in all males and never in the females. The remainder of the male abdomen up to and including the eighth segment is in no wise unusual. In the female the eighth and ninth segments (figure 19) are modified somewhat. On the sternum of the eighth segment is a slight protuberance

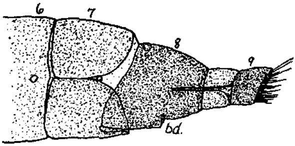

Fig. 19. Tip of abdomen of adult female. *bd*, opening of bursa duct.

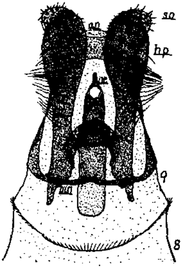

Fig. 20. External genitalia of adult male. *ac*, aedoeagus; *an*, anus; *hp*, harpe; *so*, socius; *vin*, vinculum.

which marks the copulatory opening leading into the bursa duct and thence to the bursa copulatrix. At the end of the ninth segment is the external opening of the vagina (ventrally) and the alimentary tract (dorsally). Petersen (1900) has described in some detail the female and male genital organs of Lepidoptera and shows the transitional stages from the type having one genital opening (at the tip of the abdomen) to that having two as here found. The presence of two genital openings is forecast in the pupa. On each side of the copulatory opening is found a tuft of orange-colored scales, and a third tuft is found on the dorsum at the anterior margin of the eighth segment. These three tufts are normally concealed from view under the posterior margin of the seventh segment. The lateral apodemes from the ninth project back into the eighth segment. The tip of the female abdomen is usually telescoped so that the eighth segment is partly retracted within the seventh, and the ninth is retracted within the eighth. The posterior part of the eighth is membranous. In the illustration the abdomen is shown with these segments drawn out into view. The tenth segment is not developed.

In the male (figure 20) the ninth and tenth segments are much modified and are usually retracted within the eighth. As shown in the figure, they are drawn out to expose the external genitalia. The nomenclature given is according to Eyer (1924). The tergum of the ninth forms a "roof" over the anus (an) which lies just beneath it. It is called the tegumen. Attached to its distal end are the socii (so) which really belong to the tenth segment and form the anal armature. They are paired and bear many short spines and setae. The sternum of the ninth segment consists of a narrow chitinous band, the vinculum (vin), which is fused with the tergum on each side. The paired claspers, called harpes (hp), articulate with the vinculum and are appendages of the ninth segment. They also bear many setae and short spines. The cone-like chitinous organ through which the aedoeagus (ae) projects is called the anellus and also probably belongs to the ninth segment as do the rest of the genitalia. The aedoeagus is a heavily chitinized tube supported by the anellus and tapering to a point distally. The penis itself is a soft eversible tube contained within the aedoeagus and is protruded from the ventral side of the tip of the latter.

There are on each of the segments one to seven inclusive a pair of spiracles, and visible through the ventral wall of the abdomen are the four pigmented abdominal ganglia of the nerve cord. The ganglia of the entire ventral nerve cord of all stages of this insect are deeply pigmented and usually visible externally. In the adult the appendages conceal all but the abdominal, and these are found at the second segment and at the junctions of the third and fourth, fourth and fifth, and fifth and sixth respectively. The last is larger than the others, being a compound ganglion. The third and fourth abdominal ganglia are often contiguous and sometimes are fused to some extent.

6. Genital organs and alimentary tract (Text figures 21 and 22)

The internal genital organs of the male and female are diagrammatically illustrated in figures 22 and 21. In the female the bursa copulatrix (bur) is by far the most conspicuous of these organs, and it occupies much of the anterior part of the abdomen, lying in the region of the third segment. It is connected by a duct to the external opening in the sternum of the eighth segment, and from the dorsal side of this duct near its external end there arises the long slender seminal duct which permits the passage of spermatozoa from the bursa into the oviduct and thence into the seminal receptacle (rec sem). The common oviduct divides into two ducts (ovid) from each of which are given off four ovarioles (ov), each of which terminates in a filament. The filaments on each side unite with each other. The ovarioles extend from the

oviduct along each side of the bursa to its anterior end, curve dorsally and posteriorly, then dorsally and anteriorly to a common point just above the bursa where the group from each side is attached by the filament tips to the dorsal wall of the abdomen.

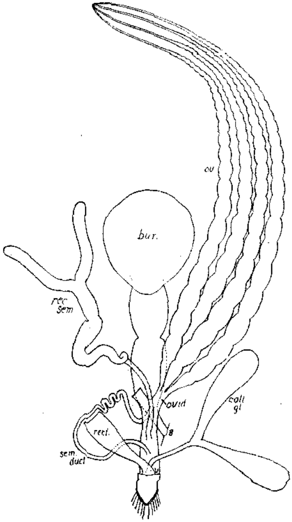

FIG. 21. Reproductive organs of female. *bur*, bursa copulatrix; *coll gl*, colleterial glands; *ov*, ovarioles; *ovid*, oviduct; *rec sem*, seminal receptacle; *rect*, rectum; *sem duct*, seminal duct.

The alimentary tract passes ventrally and to the right of the bursa, curves dorsally to pass above the union of the oviducts, then goes over the common oviduct to the tip of the abdomen, the rectum lying above the vagina. The ovarioles are of the polytrophic type, that is, the nutritive cells alternate with the ova. The seminal receptacle is bilobed and is attached to the dorsal wall of the common oviduct. The colleterial glands (coll gl) are paired and

are connected by a common duct to the dorsal wall of the vagina. They secrete the adhesive substance which attaches the egg to the leaf. In the illustration the genital organs are shown spread out and not in their normal positions.

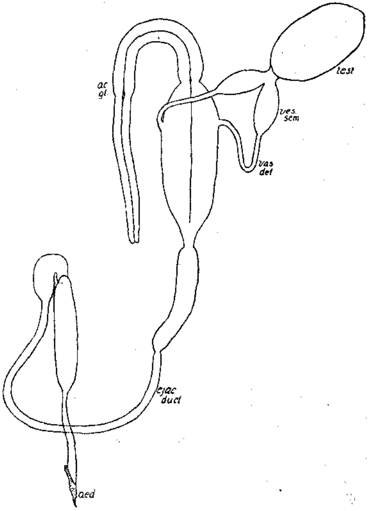

FIG. 22. Reproductive organs of male. *ac gl*, accessory glands; *aed*, aedoeagus; *ejac duct*, ejaculatory duct; *test*, testes; *vas def*, vas deferens; *ves sem*, seminal vesicle.

In the males the testes (test) are united and enclosed in a common scrotum. The vesicula seminales (ves sem) are paired and unite just under the testes. From the vesicula seminales, which are really enlargements of the vasa deferentia (vas def), the latter ducts pass to enlarged chambers which lead to the ejaculatory duct (ejac duct) which in turn terminates in the aedoeagus (ae). The accessory glands (ac gl) which presumably secrete a substance which mixes with the spermatozoa, are paired and

are connected with the enlargements at the terminations of the vasa deferentia. In some insects these glands secrete a substance which forms the spermatheca (especially Orthoptera). They occur here attached to each other rather loosely.

The alimentary tract begins anteriorly in a large muscular pharynx from which two long filamentous salivary glands are given off and extend through the thorax beside the slender oesophagus. The latter extends from the pharynx through the thorax to the mid-gut in the abdomen and gives off a slender tube which enlarges to form a rather large crop. The latter lies mainly in the abdomen over the mid-gut. In the female the mid-gut lies under the bursa and extends to a point between the common oviduct and the bursa. It is much greater in diameter than the pharynx. At the termination of the mid-gut the malpighian tubes are attached, one on each side. These are slender and each branches once. Of the two branches of each tube one divides once and the other remains single. This gives three branches of each tube which lie in the region of the ovarioles. The hind-gut extends from the origin of the tubules and enlarges at its posterior end to form the rectum which terminates in the anus. The crop and mid-gut were empty in all the specimens dissected, which adds evidence to the belief that the adults do not feed. In the male the alimentary tract passes to the right of the ejaculatory duct.

B. The Egg (Text figure 23)

When first laid the egg is a translucent white, but it becomes more opaque after a few days. In shape it is flatly ovoid, and the longest diameter is 0.25 mm. It is made to stick to the leaf by an adhesive substance which surrounds it on the leaf surface in a narrow encircling band. The hexagonal sculpturing of the surface is quite distinct, and the micropyle occurs close to one end. When it leaves the oviduct the egg is soft and flexible, and its shape changes from approximately spherical when it is placed on the leaf surface. The eggs are always laid singly and scattered over the leaf, as shown on plate XVII.

C. Larva (Text figures 24 and 25)

When first hatched the larva is minute (.35 mm. long), translucent, apodous, and flattened, a typical leaf-mining type. When it leaves the mine at the close of the third instar it has assumed a cylindrical form, the head has shifted from its former horizontal plane to a plane nearly at right angles with the body, and all the legs are present and functional. It measures about 2.5 mm. in length. When fully grown (plate XVII) the larva is about 6.0 mm. long and yellowish green in color with the setae on white

tubercles. The prothoracic shield is not conspicuous. The head is brown and typically that of a leaf-eating larva. There are the usual prolegs on abdominal segments, three, four, five, six and ten.

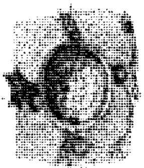

FIG. 23. Egg, much enlarged. Actual longest diameter .25 mm.

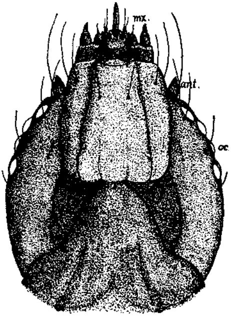

FIG. 24. Head of larva of 5th instar, ventral aspect. *ant*, antenna; *mx*, maxilla; *oc*, ocellus.

The radical change in structure which occurs at the second molt is due to the change in feeding habits and environment of the larva, for the third instar comes out of the mine to the leaf surface. This necessitates the acquisition of legs and the shifting of the plane of the head. The dorsal part of the head capsule is longer than the ventral, and this makes the posterior margin of the epicranium in the leaf-mining instars, where the head is horizontal, push back into the prothorax. Trägårdh (1913) has described structural transitions in several leaf-miners which change their feeding habits. The third instar resembles the fourth and fifth in general, but the setal pattern is somewhat different and there are fewer crochets on the prolegs. The prolegs of the abdominal segments three to six inclusive have one transverse row containing two crochets, and the prolegs of the anal segment bear one crochet.

The fourth instar is like the fifth except for size and no further mention need be made of it. The fifth instar is a typical caterpillar with the mouth-parts well developed. These are shown in a ventral view in figure 24. The antennae are minute, and there are only five ocelli (oc) present on each side. They are arranged

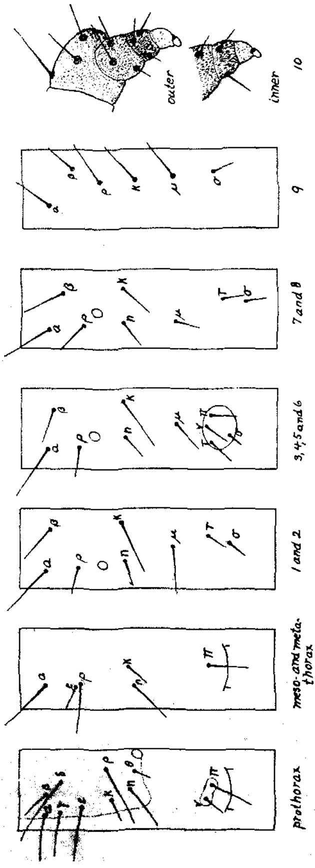

FIG. 25. Setal pattern of 5th instar larva.

in a curved row whose concavity is ventral. The lahium is drawn out into a spinneret through which the duct of the silk glands reaches the exterior. The maxillae bear on the inner surface a pair of curved chitinons hooks. Otherwise the mouth-parts are not unusual. On the dorsal surface the adfrontals extend back to the posterior margin of the epicranium and the frons is about one-third the length of the head capsule. The labrum is bilobed and the mandibles bear four "teeth."

The prothoracic legs differ from those of the meso- and metathorax in that the terminal segment bears one claw only, whereas in the case of the latter two pairs of legs the claw is protected by a pair of terminal lappets. The prolegs of the abdominal segments three to six inclusive bear on the planta two rows of crochets, three per row. The anal prolegs have a single crochet only.

The setal pattern of the body of the larva is of some taxonomic importance and is shown in figure 25. In this description the nomenclature of Fracker, though cnmbersome, has been followed. The diagrams are made so that the anterior margin of each segment is to the left and the dorsal midline is at the top. Each diagram is that of the left half of each segment projected on a flat surface. Certain segments are alike, and these have been represented by one diagram. The setae of the anal segment do not conform to those of any of the others.

D. Pupa (Text figures 26 to 29)

The pupa is spindle-shaped, about three millimeters long and brown in color. Many of the adult structures are evident, and the head thorax and abdomen are distinct. In the description here given the parts, although often incompletely developed, are named in accordance with the corresponding parts of the adult.

The vertex (vert) occupies most of the dorsal side of the head and is separated from the frons by the Y-shaped epicranial suture, the frons meeting the arms of the suture. The stem of the Y is indistinct. The frons (fr) extends caudally along the ventral side of the head from the epicranial suture to merge into the clypeal region, there being no demarcation between the two. The frons in figure 26 can be easily distinguished by the presence of the pointed cutting plate in its anterior part. This is the so-called "cocoon-hreaker" with the aid of which the pupa emerges from the cocoon. The bases of the antennae (ant) are visible on the dorsal side of the head lateral to the epicranium. On the ventral side of the head and lateral to the frons are the eye-pieces (e). The clypeus bears the bilobed labrum, and on each side of the labrum is a small triangular mandibular sclerite. Neither labrum nor mandibles are found in the adult. The labrum bears a pair

of laterally placed setae. The maxillae are prominent and form the pair of medially placed appendages extending caudally from the labrum. Neither maxillary nor labial palpi are visible. The antennae extend caudally almost to the tips of the wings. Be-

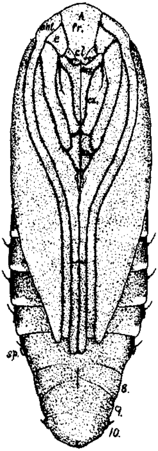

FIG. 26. Female pupa, ventral aspect, much enlarged. *ant*, antenna; *cl*. clypeus; *cx*. coxa; *e*. eye; *fr*. frons; *max*, maxilla; *sp*. spiracle.

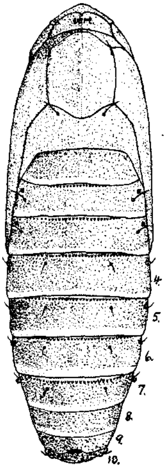

FIG. 27. Pupa, dorsal aspect, much enlarged.

tween the antennae and maxillae lie the folded prothoracic and mesothoracic legs. The tarsal regions of the metathoracic legs are visible between the tips of the antennae, most of this pair of appendages being covered by those preceding. A small part of the metathoracic coxae is visible in the midline posterior to the mesothoracic coxae. The metathoracic legs extend slightly beyond the tips of the wings. The fore wings extend to the seventh segment of the abdomen on the ventral side and conceal the hind wings. The appendages are loosely attached to each other

and are free from the body wall. They overlap, more or less, and the covered parts are quite membranous. When dissected out, the regions of the coxa, femur, tibia and tarsus are visible, although often not distinctly demarcated, and the tibial spurs are prominent. The two folds in the legs occur between coxa and femur and between femur and tibia. The tibia merges into the tarsus.

FIG. 28. Tip of abdomen of male pupa, ventral aspect.

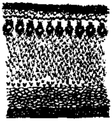

FIG. 29. Section of dorsum of abdomen of pupa.

The female has evidence of two genital openings on the ventral side, one on the posterior border of the eighth abdominal segment and one on the interior border of the ninth. These are short slits in the integument. The male has evidence of one genital opening only (figure 28), on the ninth segment. This condition in each sex corresponds to that of the adult. On the tip of the tenth abdominal segment is the indentation marking the anal opening, and on the lateral sides of this segment are a pair of short strong spines.

On the dorsal side of the pupa the prothorax is constricted in the middle and widens laterally. It lies between the epicranium and mesothorax and abuts on the antennae. The epicranial suture extends to the anterior margin of the prothorax. The mesothorax is a large quadrate sclerite separated by distinct sutures from the prothorax, metathorax, and fore wings. Along its midline it is raised into a very slight ridge. At the anterior-lateral angles are a pair of setae. The mesothoracic wings extend around the body to the ventral side. The metathorax is not so long as the mesothorax and merges indistinctly into the wings laterally. It bears also a pair of setae at the anterior-lateral angles, but these are more approximated than those of the mesothorax. The metathoracic wings are almost entirely concealed by those of the mesothorax, the bases only being visible. There are visible dorsally ten abdominal segments, of which numbers two to seven inclusive bear a pair of setae at the anterior-lateral angles, and numbers one to seven bear laterally placed spiracles. Segments four to seven inclusive bear also a pair of medially placed setae. The spiracles on the first abdominal segment are concealed by the hind

wings. At the anterior margin of the tenth segment is a dorsal tubercle bearing a pair of spines. This and the lateral spines on the tenth segment are purely pupal structures. The dorsal surface of the abdominal segments is covered with minute spines (figure 29) and on segments two to seven inclusive there is a row of heavy spines along the anterior margin.

In the male abdominal segments three to seven are movable, and in the female segments three to six are movable. The terminal segments are immovably united in both sexes.

VI. Life History and Habits

All the data here given, except for field records and other cases specifically mentioned, were obtained from records of individual insects reared in New Haven, Conn., on the gray birch, *Betula populifolia*. The field observations in Connecticut and Massachusetts are also of insects occurring on *Betula populifolia* unless otherwise stated. The period during which records were made covers the years 1924, 1925, and 1926.

The first adults appear the last of June in the region about New Haven, and the last disappear the last part of July. In 1924 adults were fairly numerous July 7th, and the last were seen July 31st. During 1926 adults were systematically collected with a net and by hand during July in one locality, a group of birches just north of Mt. Carmel, near New Haven, and these collections indicated a maximum number of adults were present the fourth week in July. During 1926 the season was later than usual. This species was abundant during the second and third weeks in July, but from the 27th to the 31st it declined in numbers from about a maximum to disappearance.

Pupae were kept at normal temperatures in an out-door screened insectary during 1924, 1925, and 1926. Those of 1924 were collected in the field during the spring of that year; those of 1925 and 1926 were reared in the out-door insectary. Records were kept of the emergence of 104 adults in 1924, 135 in 1925, and 36 in 1926. In 1924 the period of emergence was between June 4th and July 9th (only three emerged before June 23d); in 1925 between June 15th and July 19th, and in 1926 between July 2d and July 21st. The period of maximum emergence during 1924 was between June 25th and July 9th; in 1925 between June 18th and July 10th, and in 1926 between July 2d and July 9th. In 1925 all records obtained after July 1st were of individuals taken from New Haven to Woods Hole, Mass. The early appearance of adults in 1925 may possibly have been due to high temperatures early in June of that year, for, during the first ten days of June, 1925, the mean hourly temperature was 75.2°F. as opposed to 60.6°F. in 1926, and 61.2°F. in 1924 (U. S. Weather Bureau,

Hutchings (1926) reports that in Ontario the adults are found during July (up to the 25th) with a maximum emergence from July 6th to July 14th. In New Brunswick, Gorham (1922) reports adults abundant the first two weeks of July. It would seem from these reports that the adult insect appears at approximately the same time of year over much of its entire range, being at a maximum during the first part of July.

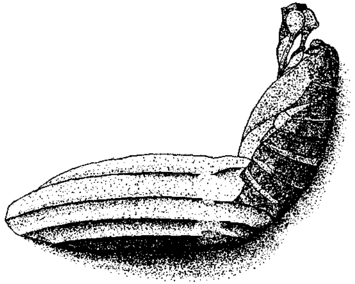

FIG. 30. Cast pupal skin and cocoon.

From the pupae collected in the field in the spring of 1926 there were secured 54 adults of which the sexes were determined. Thirty-three were females and 21 were males. Of 36 adults secured from laboratory-reared larvae, 19 were females and 17 were males. Although the females outnumber the males, the difference is not sufficiently great to warrant an assumption that there is not approximately an equal number of each sex under natural conditions.

When ready to emerge from the cocoon the insect is in the pre-imaginal stage, and the scales of the imago are easily seen through the pupal skin. The pre-imago works its way forward, probably with the assistance of the spines on the tenth abdominal segment, and breaks through the anterior end of the cocoon. The cutting plate on the vertex is of material aid in the process. When about three-fourths of the length is exposed, the body is held at an angle of about 40° from the cocoon. The pupal skin splits at the junction of the vertex and the prothorax and also longitudinally through the prothorax and mesothorax. The eye-pieces remain attached to the antennae and mouth parts. Figure 30 shows a cocoon and an empty pupal skin in the characteristic position.

According to Snodgrass (1922), the emergence from the cocoon is greatly assisted in *Bucculatrix pomifoliella* Clemens by the presence of three "valves" in the anterior end of the cocoon, these acting as an inclined plane to lift the insect. In *B. canadensisella* these structures are not present. The inner part of the cocoon is woven so that its lateral walls curve in at the base, making a "round corner," and this might conceivably give the pre-imago an upward lift. However, if a pupa is pushed gently forward by hand, it does not emerge at the normal place, but lower down near the base of the cocoon. By simply rolling over in its attempt to extricate itself, the pre-imago would bring the cutting plate in a more dorsal position with respect to the cocoon and thus insure emergence at the normal location.

During the daylight hours the adults rest quietly on the surfaces of the lower leaves of birches, or of the leaves of undergrowth under the birches, or on the lower part of the trunks of the trees. They fly very little unless disturbed, and usually remain motionless for long periods of time. The photograph on plate XVII is a three-minute exposure of a live adult which was carried to and from the camera in the position seen. It shows the adult in the characteristic position. *They can be collected very easily by simply* inverting an empty glass vial over the quiet insect and then gently tapping the opposite side of the leaf on which it rests. It will quickly fly or run up into the vial. I have collected one hundred in less than an hour from fern fronds in this manner. When disturbed, they fly quickly a few feet, very rarely over five or six, and usually much less. If confined in a bottle they run excitedly for a few minutes when disturbed.

From field observations it seems that as a rule the moths remain near the ground during the day and go up into the trees at about dusk. I have often failed to get them in a net by sweeping birches over my head, when many were secured by sweeping within four feet of the ground. Yet, in the same location, by sweeping the birches at dusk, several were netted very quickly at a height of about nine feet from the ground. In 1926 in one particular locality, moths were very abundant during the day on the fronds of ferns growing under the birch trees, but none were seen on the leaves of the birches which were not lower than four feet from the ground. An investigation of the birches at night with the aid of an acetylene lamp showed that the moths were all up on the birch leaves, and none were on the ferns below. The next day over one hundred were easily caught on the ferns, but none were on the leaves of the trees. At times, however, I have found moths on the leaves of the trees during the day five feet from the ground. Gorham (1922) reports that in New Brunswick he found moths on the birches in large numbers at all hours of the day, but he gives no further information on the distribution.

The moths prefer situations out of direct sunlight, and this may account for their position during daylight hours. This nightly migration into the trees may be affected somewhat by conditions of light, moisture, aud amount of undergrowth, but it apparently occurs to some extent wherever conditions are normal.

The response of these moths to light is not very definite, due to their habit of remaining quiescent in one spot unless greatly disturbed. Attempts to make them show either a negative or positive response to daylight in the laboratory gave inconclusive results. Several attempts to attract them to a lighted lantern, an acetylene lamp, and automobile headlights at night in the field failed completely, although they were present in considerable numbers on the surrounding trees and were relatively more active than during daylight.

From the above observations it is assumed that oviposition occurs at night. In the insectary eggs were secured from three to seven days after the adults emerged, but in view of the fact that the moths are very inconsistent about ovipositing in captivity, these data may have to be extended under normal conditions.

It was necessary to place several males and females in a cage in order to ensure a supply of eggs. Although I have no data on the number of eggs laid by any one female, an examination of the oviducts shows that there may be a considerable number, for sixty-two fully formed eggs were dissected out from one female caught in the field, and there may have been several laid before she was captured. This number of eggs was never secured from any female in captivity. From four females thirty-four eggs were secured in one day in a cage, and from these same four, fourteen eggs the following day. They died without further oviposition. These females were reared and laid only the eggs recorded.

The adults have been kept alive in cages out of doors for twelve days after emergence from the cocoon, but they usually die sooner. They have never been seen to feed, and apparently they did not touch a honey-and-water mixture placed in the cage. The presence of a 25 per cent solution of honey in the cage did not prolong the duration of adult life. Certainly food is not a requisite and is not necessary to oviposition. All the adults collected in the field died in a few days, so twelve days probably is a fairly long period of life. Humidity and temperature have considerable effect on this, and moths caught in the field can be kept alive four to nine days if held at 10°-12°C., whereas they die in one to three days at room temperature. They will remain active after an exposure to 7°C. for twelve hours, but when the air is cooled to 5°C. they very quickly become inactive.

The eggs are laid singly on either side of the leaf and on any part of the surface. There is some preference shown for a position beside the midrib or some other prominent vein of the leaf,

but not to the exclusion of the rest of the leaf (plate XVII). Eggs are laid on leaves on all parts of the gray birch. Insectary records for 1924 showed a period of oviposition lasting from July 5th to July 21st, and field observations the same year showed unhatched eggs up to August 7th. No field observations were made during 1925, but gray birches sent from Boston, Mass., to Woods Holt, Mass., on July 9th, carried many unhatched egg's on the leaves. In 1926 eggs were found in the field between July 23d and August 3d, but in view of the fact that they were numerous July 23d and that some of those collected that day hatched July 30th, oviposition must have begun as early as July 16th. Many eggs collected August 3d hatched August 15th, so oviposition occurred as late as August 1st. Oviposition takes place usually during the month of July, and unhatched eggs may be found up to the middle of August. In 1926 the incubation periods of 48 eggs from laboratory-reared adults were 15 days on the average, the maximum being 17 days, the minimum 13 days, and the majority (27) taking 14 days. In all but three cases these eggs went through the incubation period between June 25th and July 13th, a month earlier than normal. They were from laboratory-reared adults which emerged earlier than normal. The other three eggs were incubated at the normal time, between July 31st and August 14th, and they took 14 days each, so the figure for all 48 was normal. This agrees with the period given by Hutchings in Ontario in 1925. The eggs have a high degree of fertility, and those that do not hatch are rare.

A short time before the larva leaves the egg it can be seen curled inside (figure 31). When it emerges, the young larva bores through the bottom of the egg into the leaf, and as it feeds it leaves the egg filled with dark excrement. This hahit makes it very easy to determine whether or not the eggs are hatched, for after the larva has left, the egg appears hrown or hlack in contrast to its former translucent condition. For several days the young larva mines close to the egg, but it finally straightens its path and mines in a more or less definite direction.

The larva completes the first and second instars and most of the third in the mine. I have found a head capsule in a mine only twice, but the measurements of the width of the head capsules (p. 444) and the descriptions of the larvae clearly indicate three mining instars. While in the mine the larva is always oriented dorso-ventrally with the leaf: that is, its dorsal side is always toward the upper surface of the leaf. For the first week the mine is extended very little and is always close to the egg, giving a blotch appearance, due to continuous turning of the mine in a small area. A mine six days old measured only 1.5 mm. across the mined area. This larva never makes a real blotch mine, but its excavations are always linear and winding, with slightly

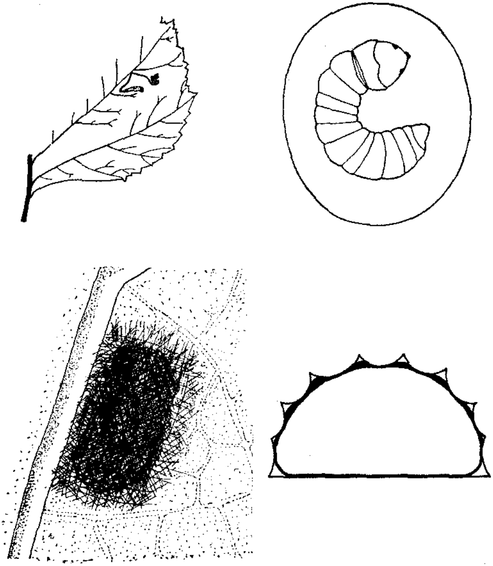

FIG. 31. Larval mine in birch leaf, slightly less than normal size (upper left); embryo in egg (upper right); larva in molting web (lower left); diagram of cross section of cocoon (lower right).

enlarged ends. During the last part of its mining life the larva lengthens the mine very rapidly and broadens it somewhat. Most of the mines are about three-fourths of an inch long when finished (figure 31).

When ready to emerge from the mine, the larva cuts a crescentic opening in the lower epidermis, an operation taking about fifteen minutes. It then works its way out until, by bending its body ventrally, it can grip the leaf surface with its thoracic feet. It then quickly pulls itself out of the mine, the entire performance consuming about two and one-fourth minutes. While emerging

from the mine, the larva spins a few long threads of silk in the shape of a figure "8." I was unable to detect any use to which this peculiar habit could be put. The opening through which the larva emerges is always crescentic, always of the same approximate size, and always cut in the lower surface of the leaf regardless of which surface bears the egg. Hundreds of mines have been examined, and these were made by larvae which hatched from eggs laid on either side of the leaf, and only once an exit was found on the upper surface.

It was thought that both light and gravity might cause the larva to orient itself dorso-ventrally with the leaf, and if this were true, the larva might be made to change its orientation by either inverting the leaf or changing the incidence of light on it. The upper surface of a leaf containing six mining larvae was covered over with black paper, and a mirror was so placed that daylight was reflected on the lower surface. This caused light to fall on the ventral surface of the larvae instead of on the dorsal, as under normal conditions. After an interval of 15 days all the larvae had emerged from the lower surface of the leaf. The change in incidence of light had no effect. A branch of a gray birch bearing several leaves which contained mining larvae was inverted so that the morphologically lower surface was uppermost. This changed the relation of the larvae to gravity. Under natural conditions the leaves never hang horizontally, so the orientation of the larvae is only relative at best. The leaves were examined after an interval of 18 days. Approximately 50 larvae had emerged from the mines, and of these only two had emerged through the morphologically upper, now lower, surface. In view of the fact that occasionally a larva emerges from the upper surface normally, the emergence of these two is of no significance. It is quite evident that changing the orientation to either light or gravity has no effect on the position of the insect relative to the morphologically upper and lower surfaces of the leaf after the mine is well under way: nor will the surface of the leaf through which the larva emerges from the mine be changed by any such procedure. In the above cases all the mines were about half finished when the conditions were changed. The orientation of the larva must be determined after it bores through the epidermis of the leaf from the egg and before it mines to any great extent, for all larvae examined were found with the ventral side toward the lower side of the leaf even when the mine was only two or three days old.

Where the insect is abundant it is by no means unusual to find 25 to 40 mines in one leaf. The mine shows more clearly through the upper epidermis of the leaf than through the lower, but this may be due to differences in the structure of these parts of the [illegible] n-

clined to gnaw through large veins, and usually the mine turns aside at these obstructions.

The duration of the mining stage varies greatly. The maximum period observed was 50 days, the minimum 13 days. This variation may be due partly to the conditions under which the larvae were reared. In 1924 and 1925 all the larvae were reared at the normal season and fed on leaves in normal condition. During these two years the maximum duration of larval life was 37 days, and the minimum 24 days. In 1926 several larvae were reared from eggs laid by laboratory-reared adults a month earlier than normal—in June, in fact—and the foliage of the birches was in a more rapidly growing and tender condition, especially since these birches were more or less sheltered and were well fertilized and watered. The water content of the leaves must have been greater than larvae would normally meet. All of these larvae but two were in the mines over 32 days, and the average period of 20 was 44 days. Of the two remaining, one was in the mine 16 days and the other 13 days. These 22 individuals are not included in computing the mining period. All of the other larvae reared during 1926, 35 in number, on which records were kept of the mining period, were in the mines 30 days or less. The duration of the mining stage during 1924, 1925, and 1926 was on the average 22 to 27 days for 50 individuals, not including the 22 mentioned above. This figure is probably correct for normal conditions. Hutchings (1926) gives the mining period as seven to eight days in Ontario, but such a short mining period would bring the larvae to a fully grown condition much earlier than they really appear in the field. There is a difference in food plants to be considered, for larvae in New Haven were reared on gray birch, whereas the common birches in Ontario attacked by this insect are the yellow (*B. lutea*) and white (*B. papyrifera*). Nevertheless in Connecticut the larvae appear feeding externally on gray and white birches at the same time, which indicates a similar mining period.

Mining larvae have been observed in the woods about New Haven as early as August 6th, and eggs collected on leaves have hatched July 30th when brought into the laboratory a week earlier. Larvae have been found out of the mines August 6th, but this is unusually early. The period when mining larvae occur around New Haven lies approximately between August 1st and September 15th, with a maximum number present the fourth week in August. The rearing records coincide with these limits.

When once free from the mine, the larva wanders over the leaf for a short time, an hour or two, and then spins its first molting web. A larva has never been seen to feed between the emergence from the mine and the spinning of the web. There may be a difference in different species of the genus, for Chambers (1882)

observed that *Bucculatrix ambrosiaefoliella* feeds two days between emerging from the mine and molting. The larva which emerges from the mine is structurally more like the following external feeding instar than the preceding mining instar. This may argue for possible external feeding, but there is no evidence that it occurs at this time. The exact interval of time between emérgence from the mine and either beginning or completion of the first molting web was determined for three larvae, all typical cases. One larva emerged from the mine at 8.20 A. M. and completed its web at 10.45 A. M.; one emerged from the mine at 9.40 A. M., began its web at 10.40 A. M., and completed it at 12.10 P. M.; one emerged from the mine at 10.09 A. M., began its web about 10.42 A. M., and finished it at 12.12 P. M. The larva often selects a position beside a large vein for its web, but it will also spin on the flat upper surface of the leaf. There seems to be a preference for a hollow over which the "roof" of the web may be spun, as the angle between the base and sides of a glass bottle or the hollow beside the midrib of the leaf. Having selected a suitable location, the larva lays down a thin basal "floor" web on the surface of the leaf. This is about 1.5 mm. in diameter. Then it spins another web over this, making long tacks from side to side by swinging the entire thorax and the first two abdominal segments from one side to the other. The body is held facing out and the threads are always straight. In shifting its position the larva swings the abdomen quickly almost 180 degrees. The periphery of the web is thus built up first, the center being weak. A series of short tacks is now made over the "frame" of long threads, and the center is strengthened. This is followed by a series of short tacks all around the edge, a proceeding which evidently strengthens the web. A hole is quickly made through the web near the center, and the larva crawls in head first between the "floor" and the "roof." In crawling into its molting chamber the larva doubles ventrally so that its back is down on the "floor" and its feet touch the "roof"; that is, it is oriented dorsally to the leaf. Before it is all inside, the larva swings its head to and fro, weaving a mat on the under side of the "roof." Since the diameter of the web is not much more than half the length of the larva, the latter is forced to turn around, and when completely inside, its head almost touches the last abdominal segment, the body being bent in a U shape and to the right or left (figure 31). It is plainly visible through the web. The larva is not content with getting inside, but actually makes a turn around its molting chamber. All this time it swings its head, weaving figure "8" loops, and in due time it incidentally has to cover the hole in the "roof" by which it entered. Although this opening is always covered, the larva seems to make no deliberate attempt to cover it, doing so eventually as it works around inside. Most of the weav-

ing is done after the larva is inside. In two instances to which particular attention was given, the time spent weaving prior to entering the web was eight minutes in each case, and the weaving time inside the web was 56 and 52 minutes respectively. In two other instances the larvae were weaving inside the web 60 and 70 minutes respectively. The principal part of the web is woven from the inside and is supported on the lighter structure previously woven from the outside. The entire process of spinning the web takes about one or one and one-half hours, varying somewhat with the larva. The procedure is essentially as described by Snodgrass for *Bucculatrix pomifoliella*. When the larvae are numerous, the birch leaves in August and September are spotted on both sides with many white webs. I call these "molting webs" rather than "cocoons," "pseudococoons," or "cocoonets," as termed by others, because I believe the word "cocoon" should be restricted to that structure, in which the pupal stage is passed.

Having completed its web, the larva retracts its appendages somewhat and remains quiescent a day or two. The tarsal claws and the crochets of the prolegs are not attached to the web, the larva lying freely with its ventral side away from the leaf. If the upper part of the web is removed, the larva falls out. Under such conditions it must molt in some sort of a chamber or fall off the leaf, which might be disastrous, for if food is not available after the molt, the larva dies in a few hours. The small size of the web holds the insect tightly, and the strong attachment to the leaf secures the web against being washed off or lightly brushed off. The web also offers protection from such enemies as ants during a period of helplessness. It is not essential to the process of molting, and seems to be an obstacle to quick molting rather than an aid. If removed from the web, the larva molts perfectly normally. Inside the web it has to pull itself around to get clear of its old skin. After one or two days in the web, the larva molts, and in a few hours, sometimes in one hour, it breaks out through the edge, at the junction of "roof" and "floor" (plate XVII). In molting, the head capsule separates from the rest of the old skin and is cast off first anteriorly. The larva then works its way clear of the remaining skin, casting it off the posterior segment of the abdomen. The molted head capsule and skin are left inside the web and separate from each other.

The manner of leaving the web shows how precisely instincts can regulate action. After it has molted, the larva normally bites a hole through the side of the web and emerges, but before molting it will not bite through and hence cannot get out even though it so desires. An individual which had just entered the web (in this case the second molting web) was rendered inert by hydrocyanic acid gas. After four minutes it regained sensibility and for the next 14 minutes made spasmodic movements while recov-

ering, being apparently normal at the end of this time. It then attempted to get out of the web by pushing agaiust the sides, having "forgotten" the reason for its imprisonment. It pushed vigorously back and forth for seven minutes, stretching the sides of the web in its endeavors to escape, but to no avail. Half a minute's work with its mandibles would have set it free, and had it molted, escape would have normally been accomplished in this manner. The instinct to bite its way out was totally lacking. Finally it began to move around inside the web and spin irregularly, then it began to weave the normal figure "8" loops, and in 28 minutes the web was finished. The larva cannot use its only means of escape from the web until the act of molting is accomplished. This individual later molted and developed normally, not being in any way injured by its treatment.

If removed from the web before it is finished, or, if it is finished, before the pre-molting quiescent stage begins, the larva will spin another web or as much of another web as is possible and will molt normally. An effort is always made to complete another web, but sometimes lack of the necessary silk, or exhaustion, or some other factor, compels the larva to stop after a few strands have been spun, and it then molts in the most convenient place. If it has entered on the quiescent stage prior to molting and has become fixed in the shape of a horseshoe, it does not straighten out when taken from the web, but retains its curved shape until it molts.

Because of the fact that the larva leaves its web so soon after molting, the duration of the instars has been calculated to include the time spent in the web made by the particular instar in question. Thus the feeding period plus the subsequent quiescent period spent in the web gives the length of the instar.

The time spent in the first molting web is much affected by temperature, and usually varies between one and four days in this climate. Many larvae spend less than 24 hours in this web, but most of the larvae are in it about two days. If this period is added to the days of mining life, we get a period of 24 to 29 days for the first three larval instars. This is not remarkably long when compared to the length of the next two instars, which together total about two weeks.

After emerging from its first molting web, the larva feeds from one to nine days, the individuals varying greatly under the same conditions. If food is withheld from the newly molted larva, it dies in a few hours, a much shorter time than if starved after feeding a day or two. This is probably the result of remaining a day or two in the molting web without feeding. During the fourth instar the larvae are restless and wander about more or less. This probably accounts in part for the variation in the length of the instar, for the rapidity of development is much

dependent on the amount of food eaten. The average duration of the feeding period for 73 individuals recorded was about four days. In only one instance was the feeding period as short as one day. Temperature affects the duration of this period to some extent, as will be brought out later. The effect of different species of birch as food will also be discussed in another section of this paper.

The feeding occurs normally on the lower side of the leaf, and the veins and the upper epidermis are left intact. The entire leaf is never consumed. It is due to this habit of skeletonizing a leaf that the insect bears its common name. The larvae will eat whichever surface of the leaf is toward the ground, and normally this is the lower epidermis. A birch leaf was inverted so that the normal lower surface was uppermost and covered with a black paper. A mirror was so placed that it reflected light on the leaf from below. The larvae normally feed on the lower side of the leaf, and under normal conditions this side is not so light as the upper. If the larvae fed on the lower side of this inverted leaf, they would feed on the lighter side and at the same time on the side normally uppermost. The two sides of the leaf differ in physical as well as chemical constitution of the surface. Of ten larvae placed on the upper side of this inverted leaf, four migrated to other parts of the plant (a normal movement), one remained on the upper side and was feeding when examined, and five went to the lower side of the leaf and were feeding. Seventeen hours elapsed between the placing of the larvae on the leaf and the final observation. Larvae were then placed on the uppermost side of an inverted leaf and watched. Usually they wandered about restlessly for a time until they came to the edge of the leaf. They then turned to the side underneath. Light reflected on the lower surface by a mirror seemed to have no effect. At times movement to the lower surface was long delayed and at times direct. It very evidently is a reaction to gravity that impels these larvae to feed on the lower leaf surface and not any dislike for the upper surface nor any negative reaction to bright light. What factors developed the habit of feeding on the lower surface only is another matter. The habit of the larva is to feed continuously over a limited area, and it does not wander far unless the food supply gives out. If disturbed, the larva usually drops off the leaf, spinning a long thread as it falls. After falling a few inches it hangs on the end of the thread a moment and then quickly ascends. The thread is spun out the tip of the spinneret, and when the larva stops its descent, it is attached to the end of the thread by means of the spinneret. When it ascends the thread, it moves its head rapidly back and forth and winds the silk on the prothoracic legs which are held forward. If there is too much silk for the prothoracic legs, the mesothoracic legs are brought into use. On

regaining its support, the larva simply drops the bundle of thread and walks away. This performance can be easily watched under the binocular if a larva of the last instar is used. The spinning activities of the larva, the quickness with which it drops from a leaf, and the distance it drops are much greater in the last instar than in the fourth. The speed with which these little insects can spin a thread while falling a few feet is remarkable. If touched, they snap the body back and forth rapidly and thus wriggle off the leaf and drop toward the ground. Yet after they have fallen some distance, they suddenly check their descent and can be seen to be hanging by the end of a thread. The silk of which this thread is formed must be spun from the silk glands and out of the spinneret as rapidly as the larva falls. The act of spinning apparently occurs automatically when the larva is disturbed.

Because of their small size and their greenish color, together with the comparatively small amount of leaf tissue eaten, larvae of the fourth instar are not so noticeable as those following. In localities where Bucculatrix is abundant, however, ten to fifteen larvae may often be found on one leaf. Heavily infested birches frequently have 25 larvae of the fourth and fifth instars feeding on each leaf. During the majority of seasons no such number is likely to be present.

The fourth instar molts as did the third, in a white silken web. This web is larger than the previous one, being about 2.5 mm. across. The larva builds the web and lies in it as previously described, being clearly visible. There is a slight difference in structure, as this larva weaves an elliptical mat after it is inside the web. This thickened part gives the second molting web a characteristic appearance, as the first molting web has this structure to only a very slight degree. The time spent in this web varies normally from one to three days, the 75 individuals recorded averaging about two days. This is, of course, affected by the temperature, as was mentioned before. When added to the feeding period this figure gives the length of the fourth instar as about six days.

The larva molts as before and emerges from the second molting web as from the first. It normally feeds on the under side of the leaf, skeletonizing it (plate XVIII), and in this instar the feeding is much more extensive. The injury to the foliage is most noticeable at this time, usually during the last of August and most of September. If the larvae are present in large numbers, all the parenchymatous tissue is consumed, and the leaf dies and drops from the tree. These larvae show greater spinning activity than those of the former instar and may be seen suspended from the leaves in great numbers in seasons of abundance. They feed from two to ten days, the period varying with the individual and being affected by climatic conditions, and an average of 48 recorded individuals gives a period of nearly seven days. This

period includes the time from emergence from the second molting web to the spinning of the cocoon. Toward the last part of the feeding period the gonads are clearly seen through the dorsal skin of the abdomen of the larva. About twelve hours before the time when the larva will begin to spin its cocoon, it stops feeding. This interval of time varies considerably and may be much less. By this time the larva has turned brown in color, due to the color of the large silk glands which run almost the entire length of the body. When ready to spin the cocoon, the larva drops from the place of feeding to the ground, spinning out a long thread as it goes. Larvae may sometimes be seen suspended from a thread about fifteen feet long. If the trees on which they are feeding are shaken, these fully grown larvae drop to the ground quickly and in considerable numbers. Having reached the ground, they crawl under a stone, a fallen branch, a leaf, or any other object lying on the ground and spin their cocoons on the under side of this. Sometimes the cocoon is spun on the ground itself. In captivity they will frequently place the cocoons on the sides of the cage close to the base. I have reared hundreds of larvae, and they all have dropped to the ground or close to it to pupate. Fletcher (1893) mentions finding three cocoons on the twig of a birch, but all the cocoons which I have found in the field have been on fallen leaves or other objects lying on the ground.

The manner in which the larva spins its cocoon is characteristic of the genus and quite unique. The earliest description of this process in the genus *Bucculatrix* is by Lyonet, who wrote to Réaumur, December 22, 1744, concerning the larva of *B. ulmella* and its cocoon. This description was not published until 1832 and has been referred to in the historical part of this paper (page 396). De Geer, in the first volume of his "Mémoires," published in 1752, described the cocoon of *B. frangulella* (see page 395), and Snodgrass in 1922 likewise described the manner in which *B. pomifoliella* Clemens wove its cocoon. These three papers go into the details of the process by which the larva lays down its threads, and from a microscopic examination of the cocoon of *B. canadensisella* it is apparent that this larva weaves its threads in precisely the same manner as does *B. pomifoliella*. The general process of weaving is similar in all four species, differing only in a few details. Chambers (1882) described briefly the formation of the cocoon by *B. ambrosiaefoliella* Chambers, and McGregor (1916) gave a brief description of the finished cocoon of *B. thurberiella* Busck. In 1892 Fletcher briefly described the general procedure of weaving by *B. canadensisella* Chambers, and in 1893 Lintner mentioned the same subject, but the latter's description is not correct, and Fletcher's description is not detailed.

The larva of *B. canadensisella* Chambers first lays down an oval mat to serve as a base for its cocoon. It does not previously weave a palisade of poles around the site selected, as do many

species of the genus. It then commences at one end of the mat to weave an outer supporting ridged structure of comparatively coarse threads (about .005 mm. thick), facing the work and backing away as the woven structure progresses over the mat in an arch. The ridges are formed by the ends of a series of loops made from one side to the other. The diagram in figure 32 gives

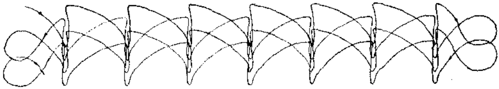

FIG. 32. Diagram of method by which larva of *Bucculatrix pomifoliella* Clemens weaves its cocoon. After Snodgrass.

the principle. Between ridges the threads cross diagonally. This figure is from Snodgrass (1922) and gives his conception of the actual motions made in weaving. As the cocoon becomes higher, the larva raises the anterior part of its body, and the radius of the structural arch is gauged by the raised part of the body as it swings from side to side, most of the body being fixed in the midline of the oval base. Possibly the prothoracic legs are used in the weaving to aid in guiding the work, as mentioned by Snodgrass and Lyonet. Certainly these legs are held up to the structure. When the cocoon is about two-thirds finished, the larva enters it, turns about, and crawls out until its head reaches the other end of the mat. It now has its anterior end outside of the cocoon but its posterior end in the cocoon. Beginning to weave exactly as before, the larva builds up the last third of the cocoon to meet the previously formed two-thirds, gradually enclosing itself as it works. When the two sections meet, they are joined by cross threads. The architecture is not perfect, for the ridges of the two sections rarely coincide, and sometimes the heights of the sections are not equal. The result is a break in the continuity of the ridges at the junction and often a sag in the contour of the cocoon. A completed cocoon is shown on plate XVIII. This outer structure is not closely woven and the insect can be seen clearly inside. It is, however, stiff and gives support to the lining which is to be woven. The sides meet the oval base perpendicularly.

Having completed its superstructure, the larva weaves a closely knit lining of fine threads (about half the thickness of the threads of the supporting structure) all around the inside by swinging its head in figure "8" loops. Where the walls of the superstructure join the base, the cocoon does not follow but makes a round

corner, as the diagram in figure 31 shows. It is this lining which makes the cocoon opaque. Snodgrass has described a series of "valves" in the anterior end of the cocoon of *B. pomifoliella* Clemens, but in the cocoon of *B. canadensisella* these are not present. The cocoon when first finished is almost pure white, but it soons turns brown. This brown color is due not to the pupa inside, for it is present before the prepupa molts, but to a change in the color of the silk when exposed to air. The time necessary to complete a cocoon is from eight to sixteen hours normally. Inside the cocoon the larva remains two or three days before pupating. This prepupal period plus the feeding period makes the fifth instar about nine days long on the average. The larva molts in the cocoon in a manner differing slightly from that which takes place in the molting webs. In the webs the head capsule is cast off entire and anteriorly while the rest of the larval skin is worked posteriorly off the anal segment. In the cocoon the entire larval skin, head capsule included, is worked off posteriorly.

The individuals which were reared in the outdoor insectary under normal temperatures in 1924 pupated from September 4th to September 25th; in 1925 from September 8th to September 13th; in 1926 from September 11th to September 23d. This does not indicate the time of disappearance of the last larvae in the field. During these three years an examination of birches about New Haven was made in order to determine the normal close of the larval period. In 1924 the last larvae were found October 9th; in 1925, September 19th; and in 1926, October 9th. The early disappearance of larvae in 1925, although not caused by any apparent natural enemy or unusual climatic condition, was exceptional. It may have been caused in part by an early season starting the life cycle earlier. In view of the fact that larvae will feed at 48° to 50°F. and will eat birch leaves until they begin to turn yellow, very few are caught before pupation by cold weather or lack of food.

The total larval life occupies from 38 to 46 days, as a rule, as the table on page 441 indicates. This is not an average of the completed larval life of a number of insects, but an average of the separate stages of many individuals, rather few of which completed the entire larval period while under observation. Nine larvae carried through from egg to pupa in 1926 averaged 41 days, the maximum being 45 days, and the minimum 36 days. This is as close as could be expected to the 38 days given in the summary for 1926. In the table below, the larval life from the hatching of the egg to the spinning of the cocoon is given for the nine individuals mentioned above. Two days as prepupa should be added to the six days of feeding in the fourth instar to give the total larval period of 41 days. It will be noticed that the larva does not accelerate through one instar if slowed down on a previous

instar, but that any retardation during the growing period is pe manent as regards time. This is borne out by the other record Seven larvae were reared in the laboratory in vials containin moist sand, and were under identical environmental condition The figures for the stages are given on pages 474-478 (larvae 131 137). The most slowly growing larva was six days in the fourt instar and was feeding six days and fifteen hours in the fifth while the most quickly growing larva was four days and nin hours in the fourth instar and was feeding four days and ninetee hours in the fifth. It will also be noticed that the quiescent perio spent in the molting web is independent of the length of the feed ing period, and as the feeding period grows shorter, the propor tion of time spent in the web during one instar grows greater. I larva number 9 in the table below, two-fifths of the fourth insta is quiescent, and in number 1, three-sevenths, but in numbers and 4, only one-fourth of the fourth instar is quiescent. Th effect of food and temperature on larval growth will be discusse later.

TABLE 1. COMPLETE LARVAL PERIOD

No.	Hatched	In Mine	In Web 1	Total Days	Feeding	In Web 2	Total Days	Feeding	Spun Cocoon	Total Days
1	8-14-26	26	2	28	4	3	7	5	9-23-26	40
2	8-11-26	22	2	24	6	2	8	7	9-19-26	39
3	8-11-26	22	3	25	4	2	6	6	9-17-26	37
4	8-14-26	20	2	22	6	2	8	6	9-19-26	36
5	8- 7-26	27	2	29	4	2	6	5	9-16-26	40
6	8-11-26	30	1	31	5	3	8	4	9-23-26	43
7	8- 7-26	27	3	30	5	2	7	6	9-19-26	43
8	8-14-26	20	2	22	5	2	7	6	9-18-26	35
9	8- 7-26	22	1	23	3	2	5	6	9-10-26	34
Aver.				26±.74			7±.22	6±.16		39±.

The chart below (text figure 33) gives the periods during which the various stages may be found in the field around New Haven Connecticut. These limits are computed from field observations and data obtained in the insectary and are broader than actual field observation alone would give. From what notes there are of the occurrence of this insect elsewhere, it seems likely that these periods are approximately correct for the entire region in which the insect is found.

TABLE 2. SUMMARIZED LIFE HISTORY OF *Bucculatrix canadensisella* CHAMBERS

Year	Adult		Egg		Mining instars					Fourth instar					Fifth instar				
	Number of individuals	Period of emergence	Number of individuals	Days in egg	Number of individuals	Days in mine	Number of individuals	Days in 1st molting web	Total length of instars	Number of individuals	Days feeding	Number of individuals	Days in 2d molting web	Total length of instar	Number of individuals	Days feeding	Days prepupa	Total length of instar	Days of larval life
1924	104	June 4 to July 9			5		44			19		19			16				
max.						32		4			7		3			8			
min.						25		*1			1		1			2			
aver.						27		2	29		3		2	5		6	†2	†8	42
1925	135	June 15 to July 19			10					34		34			27				
max.						37					8		3			10			
min.						24					2		1			6			
aver.						29		2	31		3		2	5		8	†2	†10	46
1926	36	July 2 to July 21	48		35		34			20		22			15				
max.				17		30		3			6		3			7			
min.				13		18		1			2		1			4			
aver.				15		22		2	24		4		2	6		6	†2	†8	38

* Several larvæ were in the first molting web less than 24 hours.
† The length of the prepupal stage was determined by removing several individuals from the cocoon at various times after the cocoon was completed. This stage was determined in 1926 and the 1926 figure used in computing the length of the stages in 1925 and 1924.

VII. Determination of the Number of Instars

It is very difficult to determine the number of instars by examining the mines for head capsules. A large number of mines were examined for this purpose and in two cases one capsule was found. The extent of growth and the morphological changes undergone during the mining period indicated at least two and per-

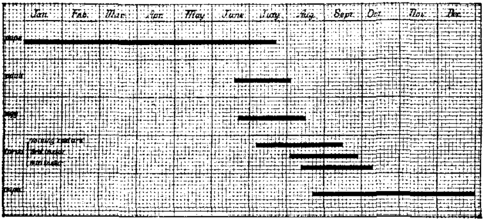

FIG. 33. Seasonal occurrence of the various stages of *B. canadensisella* in the vicinity of New Haven. The larval periods shown should read mining instars, fourth instar and fifth instar.

haps three larval stages. A number of larvae were collected in the field and the width of the heads measured. The head is not subject to growth changes during any one instar, and according to Dyar (1890) a constant numerical ratio exists between the widths of the heads of any two successive instars of a larva. If the heads of two successive instars are measured, or if a large number of miscellaneous heads are measured, the ratio for the species can be determined and the possibility of missing an instar removed. Any dimension of the head may be used, but the width is the most convenient.

Several embryos which had developed to the stage where they were about to emerge from the egg and where no further growth of the head could be expected were measured. These were all mounted in Canada balsam. As seen by the table on page 444, the average width is .078 mm., and nine of the twelve measured .076 mm., which latter figure may be considered normal. It is to be expected that the measurements for the first instar would conform to this figure, and of the sixty-one mining larvae measured, eighteen either equal this figure or closely approximate it. All but two of the eighteen equal it. The average width for the first instar is then .077 mm. Thirty-six of the sixty-one measure .114

mm. in width or very nearly so, thirty-four measuring just that figure and the other two measuring .120 mm. The normal and average for this group is .114 mm. The remainder of the mining larvae measured, thirteen, all give a head width of .171 mm. Two larvae were secured just as they left the mine and before they began to weave the molting web, and their heads measured. Both gave a width of .171 mm. These two are marked (ex) in the third column. This checked the group giving this measurement as the last mining instar. Also four larvae were found in the process of molting and with the head capsules just far enough off to permit the measurement of both the old capsule and the new head. Two of these gave the width of the old capsule as .076 mm. and the new head as .114 mm., while the other two gave .114 mm. and .171 mm. for the two widths. This gives a check on the three groups. According to Dyar's principle we should expect

$$\frac{.114}{.077} = \frac{.171}{.114} = R$$

In this case the ratio "R" is 1.5, and the number of instars in the mine is, as the figures indicate, three. To further check this principle, a number of external feeding larvae, also collected in the field, were measured. I have placed these forty-one larvae in two groups as the table shows. According to the principle used above, the measurements should be .257 mm. (.171 x 1.5 = .257) and .385 mm. (.257 x 1.5) for the fourth and fifth instars. (The actual number of externally feeding instars was determined by actual observation, of course.) In the fourth instar the average width was found to be .245 mm. for the nineteen individuals, with a variation between .228 mm. and .257 mm. The last instar, containing twenty-two individuals, gave an average width of .353 mm. with a variation extending from .304 mm. to .390 mm. It is questionable whether the two larvae whose head widths are .304 mm. belong to the fourth or the fifth instars if one judges by these two measurements alone. The average width is less than that expected in both the external feeding instars, but even so the measurements are sufficiently closely grouped in each case to determine the instar. It is to be expected that the more nearly the larvae approach the fully grown condition, the more widely will they vary in size, for the absolute extent of variation in size under normal conditions increases with age. The change in environment from the mine to the surface of the leaf, with its difference in manner of feeding involved, would also change the shape of the head, because mining larvae have relatively flatter heads. The actual measurements obtained of the heads of the first three instars is much closer to the ideal than would usually be expected.

TABLE 3. HEAD WIDTHS OF THE LARVAE OF *B. canadensisella* CHAMBERS

(All dimensions in millimeters)

	Embryo	First instar	Second instar	Third instar	Fourth instar	Fifth instar
1	.076°	.076*	.114°	.171° (ex)	.257'	.323'
2	.076°	.076*	.114°	.171° (ex)	.247'	.352'
3	.076°	.076*	.114°	.171°	.247'	.323'
4	.076°	.076*	.120°	.171°	.228'	.304'
5	.086°	.076*	.114°	.171°	.247'	.371'
6	.076°	.076*	.114°	.171*	.238'	.380'
7	.086°	.076*	.114°	.171*	.247'	.380'
8	.082°	.076*	.114°	.171*	.247'	.390'
9	.076°	.076*	.114°	.171*	.228'	.380'
10	.076°	.076*	.114*	.171'	.247'	.371'
11	.076°	.076*	.114*	.171'	.238'	.361'
12	.076°	.076*	.114*	.171'	.247'	.361'
13		.076*	.114*	.171'	.247'	.304'
14		.095*	.114*	.171'	.247'	.370'
15		.076'	.114*	.171'	.252'	.380'
16		.082'	.114*		.228'	.352'
17		.076'	.114*		.250'	.361'
18		.076'	.120*		.257'	.361'
19			.114*		.247'	.352'
20			.114*			.332'
21			.114*			.380'
22			.114*			.370'
23			.114*			
24			.114*			
25			.114*			
26			.114°			
27			.114°			
28			.114°			
29			.114'			
30			.114'			
31			.114'			
32			.114'			
33			.114'			
34			.114'			
35			.114'			
36			.114'			
heoretical average			.114	.171	.257	.385
verage found	.078±.0008	.077±.0001	.114±0001	.171±0.0	.245±.0013	.353±.003(
andard deviation	.0039	.0045	.001	.000	.0085	.025
reatest deviation from theoretical	.008	.008	.006	.000	.017	.081

In previous descriptions of the genus *Bucculatrix* it has been tacitly assumed or explicitly stated that the mining period included one instar only, and that the insect always molted on the surface of the leaf. The only mention I have found of a larva molting in the mine is in a description of the larva of *B. ambrosiaefoliella* Chambers by Chambers (1882) in which he states that the larva in question molts once in the mine, once on the surface of the leaf, and once in the cocoon. It would be well, however, to apply Dyar's principle, at least to the early stages, before making any definite statements regarding other species of this genus.

All the measurements given above were made with an ocular micrometer, using a low power of the microscope. The smallest micrometer scale division was .019 mm., and it was found impracticable to interpolate to less than one-fourth this, a measurement of .005 mm. The embryos measured were all mounted in Canada balsam. The larvae of the first three instars, marked with a small circle, "°," were also mounted in balsam; those marked with an asterisk, "*," were mounted in glycerine; and those marked with an apostrophe, "'," were specimens preserved in alcohol. All the fourth and fifth instar larvae were preserved in alcohol after fixation in Gilson-Carnoy's fluid.

VIII. Food Plants

The plants on which the larvae feed are restricted to the genus *Betula*, with the possible exception of the alder, *Alnus incana*. Johannsen, who reports (1911) the single instance of larvae attacking the alder, has also reported (1910) the presence of larvae on red oak. There are other species of *Bucculatrix* which feed on oak, one of which is very common in Connecticut, and it is very probable that the larvae referred to by Johannsen were not *B. canadensisella*. The mines in oak leaves are very similar to those of the birch skeletonizer, but the cocoons are white and are found on the trunk and branches of the trees. I have not bred this species, but Forbes (1923) gives *B. ainsliella* Murtfeldt and *B. packardella* Chambers as indigenous to northeastern United States, and both feed on oak. Alder is closely related to birch, and although the larvae of *B. canadensisella* did not survive in laboratory tests, through one complete instar on *Alnus* (*rugosa?*), under different conditions they may possibly feed on this plant. Of the species of birch on which this insect lives, four are native and one imported from Europe. These are *Betula populifolia* (gray birch), *B. papyrifera* (paper or white birch), *B. lutea* (yellow birch), *B. lenta* (black birch), and *B. alba* (European white birch) respectively. The European birch is a common ornamental tree in northeastern United States and southeastern Canada, and varieties are called the cut-leaf or weeping birch. This tree in Canada seems to be a favorite food plant, but in the vicinity of New Haven it is not quite so severely attacked as the gray birch.

Of the four native food plants, the black birch seems to suffer least, although Maheux reports (1926) that in Quebec this tree has been heavily skeletonized. Which of the other three is most severely injured seems to depend on which is prevalent in the locality. In most of Connecticut the gray birch is the preferred food plant, but on the shores of Highland Lake, where the white and black birches are the only two species common, the white birches were heavily skeletonized in 1925; and in other parts of

Litchfield County, where yellow birch is quite common, it is a favorite host. In Ontario and throughout the Great Lakes regions, the yellow and white birches are the trees which suffer most. The black birch in Connecticut is very slightly injured and usually is untouched, even though its branches intermingle with those of the white and gray birches when these two bear thousands of caterpillars. In laboratory tests the larvae ate the leaves of the black birch very readily. These larvae were taken from gray birch and fed on black birch during the fifth instar. Five of the ten larvae pupated normally, although the duration of the instar was 173 hours on the average as compared with 117 hours for the control. This delay in maturing was partly due to the delay the larvae experienced in getting accustomed to the new food plant.

The red or river birch (*Betula nigra*) is not a common tree in northern United States and southern Canada, and this may be the reason that it is not reported as being attacked by this insect. New England is about its northernmost range, and here it is found only in a few scattered places along river banks. No attempt was made to rear the larvae on the leaves of this tree, as the material is not readily available, and there are no references in the literature to it as a food plant.

There are four other genera of plants belonging to the same family as the birches and growing very commonly in the same localities as these trees. These are *Ostrya* (hop hornbeam), *Carpinus* (ironwood), *Alnus* (alder), and *Corylus* (hazelnut). Under natural conditions I have never observed any of these plants attacked by the larvae of *B. canadensisella*, although they very frequently intermingle with the birches. In the laboratory the larvae have been forced to eat the leaves of *Alnus* but could not maintain themselves on these leaves. The larva itself has really very little to do with the choice of food plants, for this is a leaf-mining insect in the early stages, and if the egg is not laid on a leaf in which the larva can live, death results. Even during the external-feeding stages it is very questionable if a larva could survive long enough to travel from an unfavorable to a favorable plant unless the two plants were very close together.

In an attempt to secure eggs on the leaves of the alder, I placed two alder twigs, each bearing two or three leaves, in a cage with five males and five females. One of the twigs had been dipped in the distillate from an aqueous extract of birch leaves, and the other was normal. The moths were collected in the field. Two females lived six days, one five days, one three days, and one two days, but no eggs were laid. In another similar trial with one female and six males, the female lived four days but laid no eggs. In view of the fact that the females are loath to lay eggs in captivity, the results are merely indicative and not conclusive.

An attempt was made to force larvae to eat the leaves of the alder and the black oak. All these larvae were collected in the field on gray birch. Five larvae in the first molting webs were placed in vials with the leaves of each plant. On the alder all five larvae died in three and one-half days or less without feeding. On the oak some feeding occurred and one larva went through the fourth instar in eight days and then died, starved, in fourteen. Three of the others died of starvation in four and one-half days or less, and one was accidentally killed. Although alder is more closely related to birch than is oak, yet the black oak was preferred as food, though it could not sustain the larvae. Ten larvae were then similarly kept with the leaves of these two plants, but the leaves were previously dipped in a distillate from an aqueous extract of birch leaves. It is sometimes possible to make insect larvae eat materials that have the odor of their food plants. Of the ten larvae used in this case, five were in the fourth instar and five in the fifth. On the alder both instars fed a little. One fifth-instar larva lived ten days, and two fourth-instar larvae lived seven days, but none went through a complete instar. On the oak there was more feeding than on the alder. One fifth-instar larva spun a cocoon after five days, and three others lived between seven and nine and one-half days. One fourth-instar larva lived sixteen and one-half days, molting meanwhile, and three others lived between five and one-half and eight days. In only one instance on the oak was the fourth instar completed. Although the distillate from the birch extract made the alder and oak more attractive to the larvae, and they ate relatively much more of the leaves when so treated, they did not show any growth except in the one instance mentioned above. All but one gradually shrunk in size and finally died of starvation before molting. Control larvae fed on the gray birch were normal in development. On this basis the possibility of larvae under natural conditions living on either oak or alder seems remote, and the reports of feeding on these plants were probably cases of misidentification of the insect in question.

Under laboratory conditions the larvae from the gray birch very readily eat leaves of paper and black birch, and larvae from paper birch just as readily eat leaves of gray birch. In all cases the larvae will mature. The trials conducted were not sufficiently extensive to determine whether or not there is a racial difference in the individuals from different host plants. This racial difference would be primarily manifested by the oviposition response of the adult, and difficulties in securing eggs consistently from females have precluded any definite experimental evidence on this matter to date. When the larvae were reared in the laboratory they were placed on the plants under trial, and if they left these plants, they were put back again. This was continued until they

ate the leaves or died. Under normal circumstances, no such condition would be met, and it is conceivable that the larvae might well starve to death in the midst of food which would sustain life, but which, for various reasons, they would not eat. The preference for birch as food, as concerns the larvae, is partly controlled by a chemical sense, for they eat oak and alder leaves more readily when these are first dipped in a distillate from an extract of birch leaves.

IX. Factors Affecting Abundance

The phenomenon of periodic outbreaks of *Bucculatrix* has been dealt with historically in previous pages. Some of the factors which have a bearing on the abundance and rate of increase of this insect deserve consideration. These may be grouped under food supply, climate, and natural enemies (including diseases). Man has not as yet played any direct rôle in the control of this species.

There is no scarcity of food plants in the northern United States and southern Canada, and the endemic population of Bucculatrix has no apparent effect on the growth of birch trees. Between outbreaks the larvae are scarcely noticeable. Paper birch forms a great part of the subarctic transcontinental forest and is a very common tree as far south as the Great Lakes and central New England. Gray birch is common farther south, and in New England and New York it is a weed tree whicb is constantly encroaching on cleared land. These two are the principal food plants and neither is being extensively cut by man. During an ontbreak. when the larvae frequently eat all the foliage on the trees over considerable areas, the birches are not killed, even by several attacks in successive years, due to the lateness of the feeding period. The greater amount of feeding occurs during the last of August and September, and at this time of the year the trees have passed through the most active season and are not so severely injured as they would be by a similar attack earlier in the summer. This insect could probably never eliminate its food plant in any given region. It very probably checks the growth of the trees the year after a severe attack, but this check would not be sufficiently great to cause a decrease in the available larval food supply. Another factor that sometimes has some effect on the abundance of a particular insect is the competition for food with other species of insects. The defoliation of the birches in any region early in the summer would very obviously affect the survival of *Bucculatrix*, which feeds late in the season. At present this factor cannot be considered as of much importance. One of the most serious insect enemies of the birch in New England is the saw-fly, *Fenusa pumila* Klug, whose larvae mine the leaves during the entire summer, as there are several generations. Since

this insect confines its work entirely to the new terminal growth, while *Bucculatrix* larvae feed by preference on the older leaves of the tree, the two live together in harmony. There is always the possibility of the last *Bucculatrix* larvae of the brood not having sufficient food, because of the work of the earlier developing part of the brood, and hence being unable to survive. The habit of spending two days in a quiescent state in the molting web increases this danger, for during these two days the foliage on the tree may be entirely consumed. All the observations made in the field indicate, however, that there is no reason to believe that there occurs any decrease in food supply which would have any very important effect in reducing the numbers of this insect even following a year when it was abundant.

No data have been obtained on the effect of climate on the survival of this species. The greatest danger to an insect is during the hibernating period, when severely cold weather sometimes kills off much of the population of certain species. It is a well-known fact, however, that insects which hibernate under the snow are better able to survive extremes of cold than species which hibernate above the snow line. For this reason a very cold winter would not be expected to have a very great effect on the population of the birch *Bucculatrix*. This is an indigenous insect and is inured to the climate of its present geographical range, and the greatest effect of climate on its abundance is probably indirectly through limitations on the distribution of its food plants.

It is not inferred that climatic variations have *no* effect on the population, but rather that climate alone is not responsible for the more or less regular rise and fall in abundance.

The parasites and predaceous enemies of this insect probably account for the increase and decrease in its numbers more than any other one factor. Ten species of Ichneumonoidea and Chalcidoidea have been reared from the larvae and pupae. One of these, *Hemiteles*, is very probably hyper-parasitic, as Viereck (1916) states that all the species of this genus are probably secondary or hyper-parasites. The 10 species with the stage of the host from which they *emerged* are listed below:

	Stage of Host
1. *Bucculatriplex secundus* Viereck Braconidae	pupa
2. *Haltichella xanticles* Walker Chalcididae	pupa
3. *Gelis urbanus* Brues Ichneumonidae	pupa
4. *Cirrospilus ocellatus* Girault Elachertidae	larva (ext. feeding)
5. *Gelis bucculatricis* Ashmead Ichneumonidae	pupa
6. *Mesochorus* sp. Ichneumonidae	pupa
*7. *Pleurotropis bucculatricis* Gahan Entedontidae	pupa
8. *Closterocerus* (*cinctipennis* Ashmead?) Entedontidae	larva (mining)
9. *Derostenus* sp. Entedontidae	larva (mining)
10. *Hemiteles* sp. Ichneumonidae	pupa

* This is a new species the description of which, by Gahan, is published in Psyche, volume 34, June, 1927.

The family names are those used by Viereck (1916). The species are all small and occur singly in the host. The extent t which they parasitize the host varies, of course, from year t year and in different localities.

In the winter and spring of 1924 there were collected 39 cocoons from which there were secured 29 parasites as follows

Gelis bucculatricis	14 specimens
Bucculatriplex secundus	7 "
Haltichella xanticles	6 "
Hemiteles sp.	2 "

These cocoons were collected from several localities aroun New Haven, where the host had been abundant in 1923. A larg number of pupae died without metamorphosing, and only 15 adult moths were secured from this lot. In 1925 most of th pupae of which records were kept were from larvae reared in th insectary, and the parasitism, therefore, was abnormally lov Nine individuals of *Bucculatriplex secundus* and two of *Halti-chella xanticles* were obtained from 352 cocoons. Conditions dur ing the 1925 season of emergence were not normal, as the cocoon had to be kept in the laboratory. The records are not comparabl to those obtained a year later. In 1926 there were collected dur ing April and May 209 cocoons in a locality where the larvae ha been very abundant the previous season. No collections had bee made in this locality during either 1924 or 1925. All thes cocoons contained pupae (as later examination showed), an from them were secured 53 parasites and 58 adult moths. Th cocoons were kept outdoors in a shaded place until the emergenc period was passed, and then those from which no insects ha emerged (98 cocoons) were examined. Five contained dea parasites and 93 contained dead pupae. Of the insects whicl emerged, then, 47.7 per cent were parasites, and of the total num ber of pupae collected 27.7 per cent were parasitized. The para sites were of the following species:

Bucculatriplex secundus	37 specimens
Pleurotropis bucculatricis	12 "
Haltichella xanticles	1 specimen
Gelis urbanus	2 specimens
Undetermined (escaped)	1 specimen

It is evident that of the insects which emerge from the cocoons the parasites make up a large percentage, and the parasites are better able to survive than the host. Of the 151 non-parasitized pupae, only 58, or 38.4 per cent, produced adults, whereas of the parasitized pupae, 58 in all, 53 or 91.4 per cent produced parasites The presence of a parasite in a pupa is very easy to determine after three months, as by this time the parasite has consumed most of the host tissue. A parasite could not have been easily over-

looked in the examination of dead pupae. Since these parasites occur singly in the host, the percentages are comparable. There is, of course, the possibility that some of the parasitized pupae died before the parasites had developed far enough to be observed in a dead and desiccated host. The fact that of the 93 dead pupae above mentioned 44 had reached the pre-imaginal stage before dying indicates that this possibility would have no great bearing on the results obtained, for had any parasite been present in any of these, it would have prevented the host from reaching the condition of the pre-imago. It is also true that the parasites are better able to withstand high and low temperatures during the period of emergence than is the host. Three lots of 20 cocoons each were kept at different temperatures, one at 31-33°C., one at room temperature which varied between 18° and 26°, and one at 8-15°. The cocoons were placed in test tubes (50 cc. capacity), 10 in each tube. To serve as a check on the humidity effect, one of the tubes of each lot contained a piece of wet blotting paper which produced a moisture-saturated atmosphere in that tube. The other tube received nothing. All tubes were kept corked except for an interval of about one minute each day when they were opened in the room in order to renew the air supply. The relative humidity of the room averaged 67 per cent, with a variation of 13-14 per cent each side of this for brief intervals of time. The experiment began June 2, 1926. From the cocoons held at room temperature 18 insects were secured, nine from each tube. This represented a normal emergence. Four of these were parasites, all *Bucculatriplex secundus,* and 14 were adult moths. From the cocoons held at 8-15°, two parasites only emerged, one from each tube. One was a specimen of *Bucculatriplex,* and the other was *Mesochorus* sp. From the cocoons held at 31-33° two parasites only emerged, both from the tube containing room air. Both were *Haltichella xanticles.* After being examined July 10th, all the cocoons from which no insects had emerged were removed to the outdoor insectary. Eight adult moths subsequently emerged from the tubes that had been held at 8-15°, four from each tube. After the emergence period was well passed the remaining cocoons were examined. No dead parasites were found, and most of the dead pupae had reached the pre-imaginal stage. Although the number of insects concerned was not large, the parasites were very evidently better able to withstand the extremes of temperature than was the host, for all the parasites emerged under these conditions, but no moths were obtained. The two parasites which came out of the tubes held at 8-15° emerged July 3, and the two from the tubes held at 31-33° emerged June 5 and June 6 respectively. In the case of the latter two, it might be suspected that the difference in development between host and parasites enabled the parasites to complete

the metamorphosis and emerge when the host could not, for they were exposed to the high temperature only three and four days. However, from a third tube set up the same as the others but containing calcium chloride and held likewise at 31-33°, there emerged two parasites only, one specimen of *Bucculatriplex secundus* on June 23, and one specimen of *Pleurotropis bucculatricis* on July 4. The cocoons in this last tube were exposed not only to the high temperature, but also to the desiccating effect of the chloride. No adult moths were secured, and no parasites died before emerging.

In addition to this emergence of parasites from pupae, there is sometimes a considerable parasitism of the mining larvae by *Closterocerus* and *Derostenus*. When these parasites were first discovered, it was thought that they were one and the same species, as they were in the larval stage and resembled each other closely. They are therefore grouped together here. If the mines of the *Bucculatrix* larvae are examined in September, many will be seen to contain the remains of the larva and in addition a very minute parasite larva about .75 mm. in length. September 10 and 14, 1925, there were collected 619 *Bucculatrix* mines in gray birch leaves. Of these, 522 were vacant and showed by the exit hole that the *Bucculatrix* larva had emerged normally. The other 97, or 15.7 per cent, contained each the remains of a *Bucculatrix* larva and one parasite larva belonging to one of the two genera in question. The only exception to this was one mine which contained two parasite larvae. The first of October, 1926, the same locality was visited and 289 mines were collected. The mines this year were much less abundant than in 1925. Of these 289 mines, 100 had been normally vacated by the *Bucculatrix* larvae and 58, or 20.1 per cent, contained parasites. The remainder, 131, contained dead *Bucculatrix* larvae, but the cause of their death could not be determined. It could hardly have been the parasites in question, for the *larvae* of these two species were found in the other mines.

The above figures show that there may be a heavy mortality of the host by the combined attack of the parasites. Of these, *Bucculatriplex secundus* is the most commonly found. Only one locality has been examined for *Derostenus* and *Closterocerus*, and it is not known just how widely spread these two species are. *Pleurotropis bucculatricis, Haltichella xanticles,* and *Gelis bucculatricis* are also rather common. One specimen only has been secured of *Mesochorus* and *Cirrospilus ocellatus*. The former emerged from a cocoon in 1926, and the latter was found in the pupal stage in a molting web of *Bucculatrix*. *Hemiteles* may be a secondary parasite and hence of no use in checking the reproduction of *Bucculatrix*. There is a possibility that some of the others also are secondary parasites.

The adults of *Derostenus* appear the last of the summer, but the adults of the other parasites appear about the same time that the host adults appear. This indicates that there may be other hosts for some of the parasites. *Bucculatrix secundus* hibernates as a larva in the pupal cuticle of the host. *Derostenus* and *Closterocerus* kill the host larva before it completes the third instar and hibernate as larvae in the mines of the host. The other species hibernate in the pupal cuticle of the host, but the hibernating stage of these was not determined. All the parasites are minute. The Ichneumonoidea adults are about 1.75-2.00 mm. in length, and *Haltichella xanticles* is about the same size. *Pleurotropis bucculatricis* is about 1.5 mm. long, and *Derostenus* and *Closterocerus* are each about .60 mm. in length.

More important as enemies of the *Bucculatrix* larvae than any one of the above species of parasites, and perhaps than all of them combined, are the various species of ants and other predaceous insects which capture the larvae when they descend to the ground to pupate. Ants will not only capture the larvae before the cocoon is well begun, but will also pull a larva out of the cocoon in which it is almost entirely enclosed. In 1925 ants destroyed the entire stock of larvae in the insectary. On one occasion the litter on the ground under a birch which had borne hundreds of larvae was very carefully examined for cocoons after all the larvae had disappeared, and not over 25 entire cocoons were found. A large number of the cocoons were partly completed. This tree had been under observation and no extensive mortality of the larvae on the leaves was noticed. There is no question that most of the larvae reached the ground, and most of these fell prey to their insect enemies before they could pupate. In collecting cocoons in the field in localities where there has been an outbreak of larvae and the trees have been practically defoliated, it is surprising to find relatively few cocoons that are entire and contain pupae.

Although no detailed observations have been made on the activities of birds, Dr. Britton informs me that he has observed certain warhlers apparently feeding extensively on the larvae. While there is no question that hirds do have some effect on the abundance of these insects, the effect of ants and other predaceous insects seems to be much greater.

The interrelations of host, parasites, and predaceous foes have been very clearly described in the case of the fall webworm by Tothill (1922), whose conclusions are here briefly summarized, and many of the reasons for the occurrence of outbreaks and the following decline in numbers of this insect are applicable to *Bucculatrix canadensisella*. Under normally balanced natural conditions the parasites are most effective and keep the host in an endemic and harmless state for a number of years. The predaceous enemies are also effective, for without their help

the host might increase in spite of the parasites. The combined attack of parasites and predaceous foes reduces the numbers of the host, but at the same time the number of parasites is reduced, for a competitive struggle for food occurs among the species of parasites and among the members of one species. During the last few days of its life in the host, the parasite is much more destructive to the host tissue than at any other time and although several parasites may start life in one host, which is particularly the case when the host becomes scarce, the only individual that survives is the one which first reaches this rapidly destructive stage, the others perishing from lack of food. The predatory enemies apparently do not discriminate in favor of the parasitized larvae, and this also tends to reduce the number of parasites. Some species of parasites may become locally extinct, and not being strong fliers, do not come in again from the surrounding territory for some years. Any environmental change favorable to the host now gives it an opportunity to increase in the absence of a large part of its enemies, and it soon reaches a stage of great abundance. After a period of years the parasites, which have now found themselves provided with an abundant food supply, increase, and finally, with the aid of the predaceous foes, overcome the host and again reduce its numbers to an endemic state. Over a long period of years the result of these opposing factors is a series of outbreaks following each other at more or less regular intervals. When the host begins to decrease markedly, the parasites also begin to decrease, since they have more difficulty in finding the host, so during the decline of the host population there is not necessarily an increase in the percentage of parasitism. For example, during 1925 the parasitism of *Bucculatrix canadensisella* mining larvae by *Closterocerus* and *Derostenus* was 15.7 per cent, and the following year, in the presence of a very marked reduction in the abundance of mines, the parasitism from these two species was increased only 4.4 per cent.

When the larvae of *Bucculatrix* are abundant there may be expected up to 20 per cent parasitism in the mining instars and an equal percentage of parasitized pupae. To this must be added a heavy mortality due to predaceous enemies. There are also certain undetermined factors, possibly both internal and external, which prevent the development of the insect beyond the pupal stage and cause the mortality of a number of pupae. These last factors are more effective on the host than on the parasite. Aside from the effect of parasites, a considerable number of the mining larvae may sometimes succumb from some cause unknown to the writer. All the factors except parasites maintain a constant attack on the various stages of *Bucculatrix canadensisella*, and when the *Bucculatrix* population begins to decline, the severity of this attack is more keenly felt. A parasite population fluctuates

with a host population and has direct bearing on the periodic ıbundance of the host but cannot entirely eliminate it, as the para-ıites decrease when the host decreases.

A species of fungus belonging to the genus *Verticillium* has 'requently been found growing on the dead pupae of this insect, ınd it was thought at first that this might possibly be the cause ɔf these fatalities. Several attempts to inoculate healthy normal ɔupae with cultures grown on oat agar failed completely. The ɔrocedure followed was to make a small opening in the cocoon ınd expose the pupa within. A drop of water containing a sus-ɔension of the spores and mycelium was placed on the pupa, which was then set aside in a petri dish for future observation. \lthough a number of inoculations were made, in not a single case lid an infection of the pupa develop, and it was concluded that he fungus concerned is entirely saprophytic. Several species of *'erticillium* are found on dead insects. I am indebted to Dr. McCormick of the Connecticut Experiment Station for determin-ng this fungus and for carrying out the inoculations.

X. Geographical Distribution

This insect, as far as reports in the literature and information .cquired directly from entomologists indicate, is found only in the ıorthern United States and in Canada. Its southern limit is North Carolina, and in Canada it occurs in New Brunswick, Que-ec, Ontario, Manitoba, Saskatchewan, Alberta, and British Col-ımbia. Mr. Hutchings, of the Entomological Branch, Ottawa, nforms me that it probably occurs up as far as the Yukon. It s recorded as far west as Minnesota in the United States. In)ntario, Quebec, New Brunswick, the New England States, New 'ork, Michigan, Wisconsin, and Minnesota it is very common nd sometimes appears in such numbers that the birches are defoli-ted. On the map (figure 34) is marked with a cross every ɔcality from which I have definite records of the occurrence of ıe insect.

According to data obtained from Sargent's "Silva of North ımerica" (1896), the four native food plants (the paper, gray, ellow, and black birches) of *Bucculatrix canadensisella* occur over much wider area than that from which the insect is reported. 'he region occupied by these birches is shaded on the map. The aper birch (*Betula papyrifera*) is very widespread and is a avorite food plant. It is found almost everywhere within the ıaded region on the map, but it is not abundant west of the Rocky Mountains nor south of Minnesota, Wisconsin, Michigan, and New York. The red birch (*Betula nigra*) is not a common tree ı northern United States and I have no records of its being ttacked by this insect. Its range extends much further south

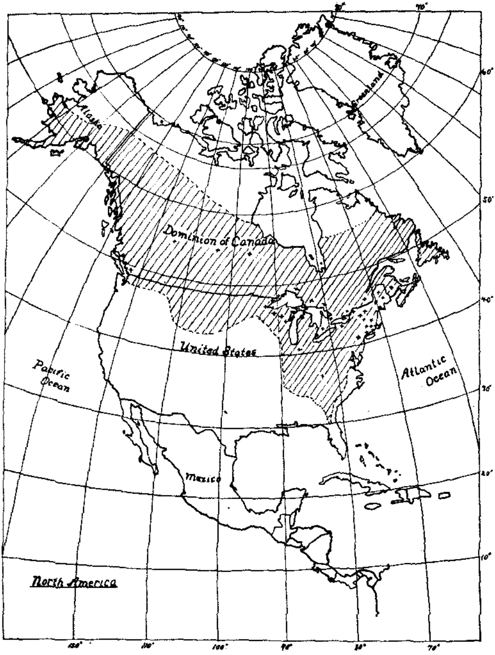

FIG. 34. Distribution of *Bucculatrix canadensisella* Chambers and its food plants. The shaded area shows the distribution of the gray, paper, yellow, and black birches. The crosses indicate localities from which the insect has been recorded.

than that of the other birches. The parts of North America in which these food plants (*B. populifolia, B. papyrifera, B. lutea,* and *B. lenta*) are found corresponds very closely with the boreal and transition zones as outlined by C. Hart Merriam (1898), except for the Rocky Mountain region of the United States. In

Indiana, which is just south of the transition zone, the insects are not plentiful, and in New Jersey they are reported from two counties, Essex and Morris, both in the northern part of the state, and both within the transition zone. In North Carolina adults have been collected in Jackson County. Although the geographical distribution of the birches in the North includes Newfoundland, there are no records of the occurrence of *B. canadensisella* on that island. It is possible that the distribution of this insect coincides with that of the paper, gray, yellow, and black birches, but the map clearly shows that it is most commonly found in the region around the Great Lakes and thence east to the Atlantic Ocean.

That the pupal stage can withstand low temperatures is quite evident, for the region around Port Arthur, Ontario, and the northern shore of Lake Superior very frequently reaches between -20°F. and -30°F. Temperatures would not interfere with the spread of the insect rather far north in western Canada, for the isotherms during the winter run in a curve from Quebec south, and then north through Saskatchewan and Alberta, making the Dakotas, the northern shore of Lake Superior, and the region just north of it much colder than regions directly to the east and west, and this insect is frequently very abundant along the northern shores of Lake Superior. The fact that it hibernates on the ground under leaves and under the winter snow also enables it to endure a very cold climate. It would not be surprising if an examination of white birches during the last of the summer in the northern limits of the range of this tree would reveal the presence of this insect. The southern limit of the insect is also very probably the southern limit of its food plants. This is a very small and inconspicuous moth, and unless it is present in large numbers, it is easily overlooked. As the larval food plants become scattered along the limits of their geographical range, the insect becomes less noticeable. That it has not been reported from more localities is not surprising.

During seasons when it is not very abundant over any great area, the infestations of *B. canadensisella* are often spotted, and a small group of birches may have their leaves completely skeletonized, while one hundred yards away the leaves of others are practically unharmed. This is in all probability due to the fact that the insect flies very little and very rarely goes beyond the shelter of the birch trees.

The insect has probably reached its present geographic range by entirely natural means of spread, for its habits preclude any great distribution by human agencies. It is found on the trees only in the larval state, and then on the leaves only. If birch trees are shipped any distance, transportation always occurs when the tree is dormant and bears no leaves. Birches are cut after the leaves fall, so that there is little probability of cocoons occurring on cut timber. Early records of forest-inhabiting species of

insects are none too common in North America, and *B. canadensisella* was probably very prevalent over the entire area from which it has been reported before Chambers described it in 1875. Even today it attracts no attention except during those periods when it becomes extraordinarily abundant and defoliates the trees.

XI. Effect of Temperature on Development

In view of the fact that temperature seems to be a very important factor in the development of these insects, experiments were carried out to determine the effect of different temperatures on the larva during the period when it was feeding externally on the leaf; that is, during the fourth and fifth instars. The temperatures used ranged from 10° to 35°C., and each temperature was held as nearly constant as possible under the conditions. Those at the lower end of the range, 10°, 11°, 12°, were obtained by using ice-boxes. Incubators were used for 25°, 29°, 34° and 35°, and an incubator was cooled with ice for 14° and 15°; 20°, 21° and 22° were laboratory temperatures. Observations were made at 8.00 A. M., 2.00 P. M., and 10.00 P. M., or as close as possible to these hours, each day, and the temperature and condition of the larvae noted. This gives a possible error of four to five hours in the observations, but in a series of observations this error tends to be compensated. The temperature for any given larval stage is the average of all the readings, and the charted temperatures are those obtained daily by averaging the three temperatures for the day. In all cases a fairly constant daily temperature was held. The temperatures were averaged for each individual larva, and the fluctuations of a degree in either direction made the mean temperatures for different larvae kept in the same location vary slightly. For this reason the groups tabulated under 11° and 12° were both held at the temperature charted on line (c), text figure 35, those tabulated under 14° and 15° were held at the temperature charted on line (d), those under 20°, 21°, and 22° on line (e), and those under 34° and 35° on line (h). In some stages there is a difference of only one degree between groups with very little difference in the duration of the stage at the different temperatures. This is due not only to the fact that one degree would not be expected to show much difference under the conditions, but also to the method of averaging temperature readings. The tabulated temperatures are correct within one-half of one degree; that is, if the temperature for one larva during the fourth instar averaged 20.4°C., that larva was placed in the 20° group. A difference of one-tenth of a degree in the average might throw the larva into a higher group, for if the temperature averaged 20.5°C., the larva was placed in the 21° group.

In view of the fact that the larvae kept in ice-boxes were in darkness, eight larvae were reared in a dark box at the laboratory room temperature, 20°-21°C., as a check on the effect of absence of light. Two of these died in the fifth instar and the other six pupated. The mortality was not exceptional. The mean duration of the fourth instar was 125 ± 5.1 hours, with a standard deviation of 21 hours; the mean duration of the fifth instar was 131 ± 4.3 hours with a standard deviation of 18 hours, and the mean duration of the entire external feeding period was 248 ± 6.8 hours with a standard deviation of 25 hours. These periods are practically the same as the periods of larvae reared at the same temperature in the lighted laboratory, and the absence of light caused no error.

The larvae were reared in individual glass vials as described previously, and the relative humidity was kept constant by wet sand in the vials. The leaves used as food were renewed as often as was necessary for keeping the food material fresh and unwilted. At temperatures of 25° and higher, the leaves were renewed daily; at 14°, 15°, 20°, 21° and 22°, every other day; at all temperatures below 14°, twice a week. The leaves used were all from the lower parts of gray birch trees, that is, the older leaves, and in all but three or four instances were from the same group of trees. Leaves selected were as uniform as possible. All the larvae used in this experiment were obtained from gray birches bordering a field about eight miles north of New Haven. The large number of larvae reared at room temperature (20° and 21°) was due to the fact that a control of each lot of larvae was kept at this temperature.

Four larval periods were considered: (1) the quiescent period in the second molting web; (2) the fourth larval instar, which includes the period in the second molting web; (3) the fifth larval instar up to the spinning of the cocoon; (4) the entire period of life spent outside the mine, which includes the fourth and fifth instars. Although the fifth instar really includes a prepupal period in the cocoon, observations on this period were not possible without disturbing the conditions of the experiment, so this prepupal period was omitted. The actively growing period of the larva is over when feeding ceases, and the omission of the prepupal period does not affect the results. In each case the endpoint is sharply defined.

The chart on page 465, figure 35, gives the temperatures at which the different groups of larvae were kept, and the letter in parentheses at the left of each temperature curve corresponds to the same letter opposite each temperature in tables 4 to 7 and indicates the curve for that temperature group. In the tables are given the number of each larva, the day it began the period

represented by the table, the duration of that period, the mean duration for each temperature group, and the standard deviation for each temperature group (in parentheses after the mean). The temperature at which any larva or group was held, together with the temperature fluctuations during the period, may be ascertained by examining the temperature chart (figure 35). Fluctuations occurred one degree each side of the mean except in a few cases where a brief fluctuation of two degrees is found. The latter cases were so few and the variations in temperature for any one larva were of such brief duration that the results are not affected. Table 8 on page 481 is a condensation of the other tables and gives the data which form the basis for the curves shown in figures 36 to 40. These curves show the relation between temperature and development.

Each figure contains two curves. The curve marked A gives the duration of the period in hours for each temperature within the limits of the curve. The abscissae represent degrees centigrade, and the ordinates, on the left of the figure, hours. The number of degree-hours (developmental units) required for development at any temperature may be calculated from this curve by multiplying time by temperature. If the curve conformed to the formula of a true equilateral hyperbola, the number of degree-hours for each point on the curve would be the same, according to the mathematical definition of the curve, and this constant figure would be the so-called "thermal constant." In no two consecutive temperatures of the experiment were the number of degree-hours equal or approximately equal, and the curves clearly show that no thermal constant exists in the development of the larvae under these experimental conditions. The curve marked B gives the index of development for each degree of temperature. The abscissae are the same as those of the A curve, and the ordinates, on the right of the figure, are the reciprocals of the ordinates of the A curve. Each point on the B curve gives that fraction of the total development which is completed in one hour at that particular temperature. The curve thus gives the rate of development directly and changes in that rate corresponding to changes in temperature. If curve A conformed to the formula of an equilateral hyperbola, the curve B corresponding to it would be a straight line by definition, but A is not an equilateral hyperbola, and B is not a straight line. Where a thermal constant exists, the rate of development curve B is always rectilinear, and if a thermal constant exists for any narrow range of temperatures, within that range the developmental curve is straight. According to the data and the curves, there is no thermal constant over any range of temperatures greater than the error of the experiment. In drawing the curves, the points were plotted for the A curve from the experimental data, and the curve was made to

conform to these points as closely as possible. These points are enclosed in small circles in the figures. The index of development curve B was then drawn to conform to curve A, and the reciprocals of the plotted points in A are enclosed in circles in B. In the absence of a thermal constant, the rate of development of the larvae and the degree-hours required for the completion of any stage must be calculated from the curves directly. No attempt has been made to project the curves beyond the limits of the experimental data.

The lowest constant temperature at which larvae would survive the fourth and fifth instars and pupate was found to be between 10° and 12°C., and the highest temperature was found to be slightly under 34°C. Eight larvae in the first molting web were held at 6°C. [line (a)] 6 days, during which time they did not molt, and four larvae were held at 3°-6°C. [line (a)] 10 days. during which time no molting occurred. The duration of the period in the molting web at 21° is about 40 hours. All twelve of these larvae molted within 29 hours after removal to the laboratory, where the temperature was 20°-21° [line (e)]. Development thereafter was normal. Six larvae in the first molting web were kept at 9°-10°C. [line (b)]. None of these completed development, but three molted within 9 days and lived 50 days. 39 days, and 10 days respectively, after the molt. The other three died in the web without molting. Ten larvae in the second molting web were kept at 9°-10°C. [line (b)], and all molted within 8 days. Four died in 24-45 days, and six pupated in 18-30 days. Controls of all these larvae kept at 20°-21° in the laboratory were normal and had a mortality of zero (25 larvae in all). It is quite apparent that although some development occurs at 9°-10°C., the continuous exposure of larvae in the fourth instar to this temperature is fatal. If the larvae are in the fifth instar, they may or may not complete development, depending on individual hardiness. Ten lárvae in the first molting web were kept at 11°-12°C. [line (c)]. All molted within 4 days, 8 completed the fourth instar, and 7 pupated. Ten larvae in the second molt web were held at the same temperature. Eight of these molted within 3 days and pupated. Controls of these two lots were kept at 20°-21° in the laboratory [line (e)], were normal in development, and had a mortality of 2 larvae in 22. At 11°-12°C., development is slow but otherwise is normal. It may possibly be that the fifth-instar larvae are more able to withstand low temperatures than the fourth. Death at 9°-10°C. seemed due to starvation, the cold preventing the larvae from feeding, and even under normal conditions the fifth-instar larvae eat more constantly than do those of the fourth instar. The larvae at this low temperature were always sensitive to touch, and sometimes spun silk threads. It appears as if the first effect of the cold was to stop feeding activity. The

larvae then shrunk in size and finally died from lack of nourishment. The curves (figure 39) of development for the period including the fourth and fifth instars necessarily begin at 12°C., in accordance with the above facts.

At the high temperatures (34°-35°) the effect was somewhat different. The procedure was essentially similar to that described for the low temperatures, and the temperature line (h) in figure 35 depicts the temperature used. This temperature was also fatal to fourth-instar larvae if maintained continuously, but the larvae were able to molt, complete the fourth instar, molt again and begin the fifth instar. None pupated, however. Feeding was very actively carried on until about 12-24 hours before death, and starvation was not a factor to be considered. Fifth-instar larvae molted and pupated without difficulty. The data for the larvae at these temperatures is given in the tables. Since the total feeding period could not be completed at 34°-35°C., the curve of this period stops at 29°C., the highest temperature at which the larvae completed two instars and pupated. At the high temperature, as well as at the low, the fifth-instar larvae seemed better able to endure the adverse conditions and fed more consistently. The lethal high temperature, using the curve as a guide, is in all probability very close to 34°C.

The above data demonstrate that a real threshold of development ("developmental zero") and a real maximum lethal temperature are determinable only when the length of exposure to those temperatures is considered, and that some development may occur at temperatures beyond the lethal high and low (for the entire period) if these exposures are not too prolonged. The difference between that temperature which gives a maximum speed of development and the lethal high is much less than the difference between the same maximum and the lethal low, but development occurs at both extremes. For example, at 9°-10°C., the fourth-instar larvae will ultimately die, but some development will have occurred meanwhile. The same is true of 34°-35° and even higher, for in another experiment an exposure to 37°C. for a few hours caused neither cessation of feeding nor other deleterious effects. In calculating the effect of low temperatures on the life cycle of insects, it has been customary to eliminate all "ineffective temperatures"; that is, all temperatures below a given threshold, this threshold depending, of course, on the insect in question. Theoretically the developmental curve B (figures 36 to 39) should cut the temperature axis at the threshold of development. The corresponding theoretical point on the time-temperature curve A would be at infinity. The curve B, however, shows no marked inclination toward the temperature axis at its lower end, and it would be rash to predict from any data obtained by a time-development study just where it is going to cut that axis. Under natural conditions the temperature fluctuates considerably, and

even though it should rise above or sink below that point at which the larvae could not complete development, some development would probably take place at these extremes of the fluctuations. The fact that the curve A is not a true equilateral hyperbola and the curve B is not a straight line makes it inadvisable to project these curves beyond the experimental data in order to determine theoretical points, and no attempt has been made to determine an absolute threshold of development.

The curves A and B in figures 36 to 39 show clearly the depressing effect of high temperatures on the larvae. According to these figures the maximum rate of development would occur at 30°-31°C., and the experimental data give the maximum rate at 29°C., no experiments being carried out between 29°C. and 34°C. Either side of the 30°-31° point, the rate of development is slower, whether the temperature rises or falls.

The curve B shows the rate at which the speed of development varies and the direction of this variation for each degree of temperature. Beginning at the lowest point in the curve, the rate at which development is speeded up increases with each increase in temperature until at a certain point, the steepest part of the curve, a maximum is reached. At this point fluctuations in temperature have their greatest effect on the development of the larvae. As the temperature increases above this point, the rate at which development is speeded up with the rising temperature decreases until the point of maximum rate of development is reached, 30°-31°C. Any increase in temperature beyond this causes an actual decrease in the rate of development. It is this variation in rate of development which forbids the "summing" temperatures on a "developmental unit" basis.

In all four figures (36 to 39) the curves are sigmoid. In the curves representing the total external feeding period, those temperatures beyond 12°C. in one direction and 29°C. in the other are omitted, due to the non-survival of larvae beyond these points, but the curves take the same general form as the others. The effect of temperature in these experiments was similar for both quiescent and active periods. The shorter periods give the better developmental curves, for as the period lengthens the index of development becomes less numerically, and the curve "flattens," if the system of coördinates remains unchanged. In figure 40 the rates of development as actually obtained have been plotted on logarithmic paper, and the curves give a correct impression of the relative effects of temperature for the different stages. The curves are much more nearly parallel than those plotted on arithmetic paper and show that the effect of temperature on the rate of development of the different stages is somewhat similar.

Due to the small scale on which the curves are drawn, the steepest part of any one of the curves is somewhat difficult to determine by mere examination. However, a calculation of the tangents of

the curves at all temperatures shows that for the period in the second molting web this steepest part lies between 21° and 22°; for the fourth instar, between 23° and 24°; for the fifth instar, between 24° and 25°; and for the total external feeding period, between 23° and 24°. The tangents of these parts of the curves are 1.8855, .6335, .4280, and .2300 respectively. These tangents are calculated for the rate curves as drawn. The lower temperature at which this is found in the period spent in the second molting web may be due to the inactivity of the insect. The temperature relations for the two feeding instars approximate each other fairly well.

A theoretical use of such curves as those marked B in the figures in considering the development of an insect under natural conditions where fluctuating temperatures occur is in the prediction of the time taken to complete a stage of development. In making such calculations, if the mean temperature of a short duration of time, a few hours, for example, be ascertained and the index of development at this temperature be multiplied by the number of hours during which this mean temperature is considered effective, the amount of development completed during this time can be approximately determined. When the sum of these last determinations equals 1, the development is theoretically completed. This is the method proposed by Sanderson (1908) and seems to be more logical than any alternative method. In practice it has been customary to determine the mean temperature for each hour. The method more commonly used in determining amount of development during short intervals of time under conditions of fluctuating temperatures depends on the assumption that the changes in velocity of development vary directly with increases in temperature and that the velocity curve (B in the figures in this paper) is a straight line for a certain temperature range, if not for all temperatures between the "threshold" and the "maximum." With such an assumption there exists a thermal constant within certain temperature limits ("medial" temperature according to Shelford—1926) and the number of developmental units required to complete development is this thermal constant, i. e., the product of time by temperature. If the amount of development completed during a brief interval of time be computed, it will represent a fraction of the thermal constant (*not* of 1), that is, a certain number of developmental units. When the sum of these determinations, the total of developmental units, equals the thermal constant, development is theoretically completed. The fault with this method lies in its uselessness when the velocity curve is not a straight line, and even if part of this curve is assumed to be straight, the method is not good for fluctuations outside of this temperature range. The small scale on which curves are plotted sometimes gives an erroneous impression of rectilinearity.

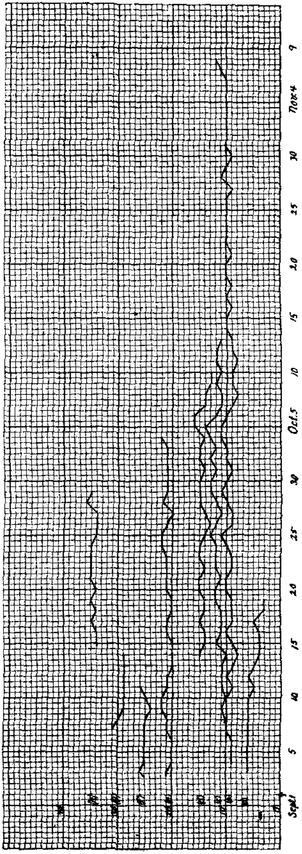

FIG. 35. Chart of temperatures of incubators, etc.

Any method of estimating insect development by averaging widely fluctuating temperatures has its faults, because the development of an insect at a constant temperature is not uniform (Crozier 1926). An approximation is the best that can be attained.

Although it is not the purpose of this paper to enter into a detailed discussion of the effects of temperature on insect life, a comparison of the results here obtained with those of some others is of interest. For further information on the subject the works of Bachmetjew, Sanderson and Peairs, Headlee, Krogh, Glenn, Peirce, Shelford, Payne, and Crozier may be consulted.

Glenn (1922) has attempted to show that in the case of the pupae of the codling moth the rate of development curve becomes a straight line when all the temperatures below a physiological zero (in this case 52°F.) are eliminated from the calculations of the mean temperatures and suitable corrections are made for the high fluctuations above the point of maximal rate of development. The data were obtained under field conditions, and the temperatures are therefore averages of daily fluctuations. However, if the calculations are made of the values the lower points (5.1°, 6.8°, 7.0°, and 8.6° effective temperatures) should have in order to fall into the corrected curve, it is found that in every case the value is lower than the actual data give. The differences are small, but the error probably lies in the fact that some development actually occurred during some of the fluctuations below 52°F., and the elimination of these low temperatures from the calculations caused a slight deviation from the expected results.

Recently Shelford (1926) has used the data of Krogh (1914) on the development of the pupa of *Tenebrio molitor* to demonstrate the fact that within a certain temperature range the rate of development curve may be rectilinear and a thermal constant may be used. In this particular case the range was between 18.5°C. and 28°C. Crozier (1926) has shown that the simple fact that an animal has passed a fraction of its developmental time at a certain temperature does not necessarily mean that that particular fraction of its development has been completed, for the rate of development is not uniform at any one temperature for the entire duration of the period in question, and the curves of development at any two temperatures are not superimposable. Thus, if one-half of the developmental period is passed at a given temperature, more or less than half the development is completed, and when a shift is made to another temperature, there remains more or less than one-half of the development to be completed at the new temperature. Since the curves of development at the two temperatures are not superimposable, the duration of the total period at the two temperatures would depend, among other things, upon which of the two the animals were first exposed to. This fact

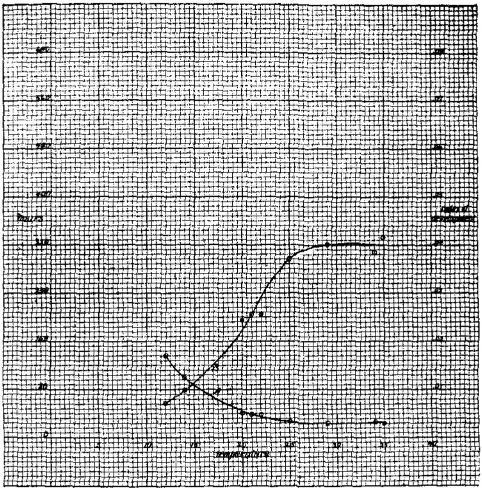

FIG. 36. Effect of temperature on the period in the second molting web. A is the time-temperature curve, and B is the rate of development curve.

alone would throw doubt on the justification of using a thermal constant for any range of temperatures. Moreover, the actual data of Krogh show that the curve is not truly rectilinear even between 18.5° and 28°, but is slightly sigmoid. The calculations were made from Krogh's data, and the last figures are added to show the trend of the curve outside the range in question.

Temperature	Tangent to curve	Angle of curve
18.0 -20.9° C.	.8143	39° 9′
20.9 -23.65	.8291	39 40
23.65-27.25	.8500	40 22
27.25-32.7	.5321	28 1

If the curve were rectilinear between 18.5° and 28°, the second and third tangents at least of those given above should be equal. Moreover, according to Krogh's own statement the Q 10 of the

Van't Hoff formula does not hold for the relation of temperature to development in this particular experiment. Most curves showing this relation have the curvilinear form, and the assumption of rectilinearity for any part of such curves is hardly justifiable.

In attempting to express the relation of temperature to development Crozier and others have brought into use the critical thermal increment of the Arrhenius formula. This formula is as follows:

$$K_2 = K_1 e^{\frac{\mu}{2}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)}$$

K_1 is the rate of development at the absolute temperature T_1, and K_2 that at T_2; e is the base of the natural system of logarithms, and 2 is the gas constant. μ is the temperature characteristic expressing the critical thermal increment. It has some theoretical significance because it expresses the heat change accompanying the conversion of the participating molecules in the reaction from an "inactive" to an "active" state, and hence corresponds to the sum of the heats of dissociation of the substances taking part in the reaction. The formula gives consistent results for catalytic reactions in pure solutions, and the value of μ is constant over a wide range of temperature.

Blackman (1905) put forward the suggestion that in enzymatic reactions such as characterize biological phenomena, the pace of the entire reaction is governed by that of the slowest reaction of the series composing it, and it is this principle of catenary reactions being controlled, as regards their velocity, by the slowest of the catenary series that Crozier has developed and used in explaining the relations of temperature to growth as well as to other biological processes. Within a certain range of temperatures a certain reaction may be the slowest in the process and hence will govern the speed of the whole, but when the temperature rises above a definite point, another reaction of the chain becomes the slowest and hence the governing one. Within the temperature range governed by one reaction of the series, the temperature characteristic for that reaction is the temperature characteristic for the whole process, and when the second reaction becomes the governing one, a different characteristic, that of this second reaction, governs. In a monomolecular reaction the curve obtained by plotting the logarithm of the rate against the reciprocal of the absolute temperature is rectilinear, as can be readily seen from the formula of Arrhenius. The problem becomes one of getting the value of the critical thermal increment (temperature characteristic) for the process at different temperatures and plotting the above curve. If this is rectilinear, the value of μ is constant, and a temperature constant for the process is obtained.

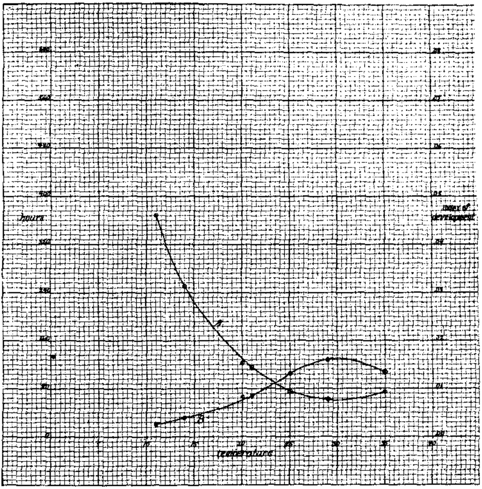

FIG. 37. Effect of temperature on the fourth instar. A is the time-temperature curve, and B is the rate of development curve.

In calculating the value of μ for the development of *Bucculatrix* the period in the second molting web and that of the fifth instar will be considered, as they give two distinct phases in the larval life, and in this particular case contain the data for the most larvae. The values are as follows:

Second Molting Web Temperature	μ	Fifth Instar Temperature	μ
12°-14°	24468	12°-15°	20644
14 -21	23003	15 -21	16637
21 -25	16396	21 -25	14709
25 -29	3431	25 -29	9694
		29 -34	—7793

The values for temperatures above 29° are included simply to indicate the trend of the curve. There is a non-survival of larvae at these high temperatures and the values are of no significance here. A steadily declining value of μ is shown, and if a curve of log rate against reciprocal of temperature were drawn, it would be curvilinear and not straight. The data of Krogh referred to above give the same type of curve, as the following figures, calculated from them, show:

Temperature	μ
13.45°-15.55°	32989
15.55 -17.00	25040
17.00 -18.80	28400
18.80 -20.90	26673
20.90 -23.65	19475
23.65 -27.25	15362
27.25 -32.70	7589
32.70 -32.95	18203

In the case of the last figure in the column the temperature is too close to the preceding to permit any significance to be attached to the value attained. The temperature characteristics, although showing the same tendency of variation, differ in their absolute values from those of *Bucculatrix,* as would be expected. In both cases an increasing temperature gives a decreasing value of μ. The work of Brown (1926) on the development of an instar of various Cladocerans, and that of Bliss (1926) on the prepupal period of Drosophila, however, show a constant value of μ over considerable temperature ranges. Thus Brown finds the following characteristics for Cladocerans:

	Temperature	μ
Simocephalus serrulatus	15° -24.6° C.	16950
	24 -32	4780
Monia macrocarpa	11 -20	28500
	20 -27.6	17210
	27.6-33	7410
Pseudosida bidentata	14 -27.5	19800

Bliss derives the following values for Drosophila:

Temperature	μ
12° -16°	33210
16 -25	16850
25 -30	7100

Crozier (1926) has stated that "there is as yet scarcely sufficient evidence to verify the prediction that the curve relating log velocity of growth to 1/T, when velocity equals reciprocal of

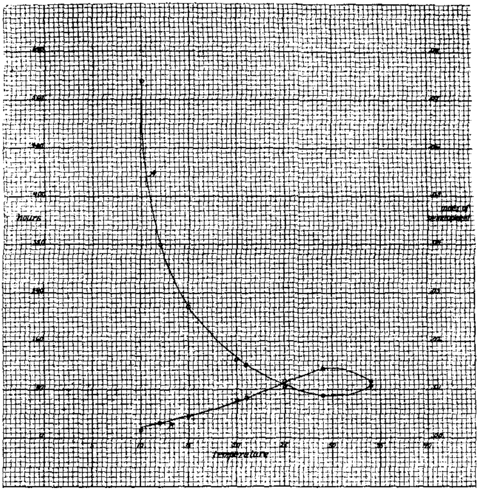

FIG. 38. Effect of temperature on the fifth instar. A is the time-temperature curve, and B is the rate of development curve.

time required to reach a defined stage, should be slightly curvilinear. But there is an indication that growth velocities, where evidenced as constant rates of increase, adhere satisfactorily to the Arrhenius formula; and even when we may quite reasonably expect that an autocatalytic system is involved, the agreement is quite as good as might be desired. The values of the temperature characteristics of growth phenomena are quite varied, yet they cluster quite definitely about the following magnitudes: 7-8,000; 11-12,000; 16-17,000; 20,000; 24,000; 27,000." He brings a considerable mass of evidence to support this view, and for a detailed discussion his works may be consulted. It is simply desired here to compare the values for *Bucculatrix* with those for other animals and to call attention to the fact that different species vary. Heilbrunn (1925) has offered some criticism of the

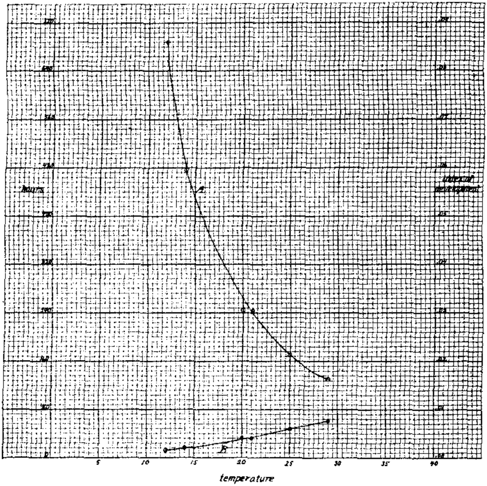

FIG. 39. Effect of temperature on the total external feeding period. A is the time-temperature curve, and B is the rate of development curve.

use of the critical thermal increment of Arrhenius in relation to biological processes of a complex nature and involving several physical as well as chemical reactions, and the identification of basic biological processes by comparing temperature characteristics is open to question.

The effect of temperature on the development of the larvae of *Bucculatrix canadensisella* may be summarized as follows:

The lowest constant temperature at which larvae will complete development is between 10° and 12°C., and the highest temperature is slightly under 34°C.

The curve of the rate of development is sigmoid, and above 30°-31° the temperature has a depressing effect.

In view of the fact that larvae will live for a considerable period of time at 10° and even develop somewhat, although this tempera-

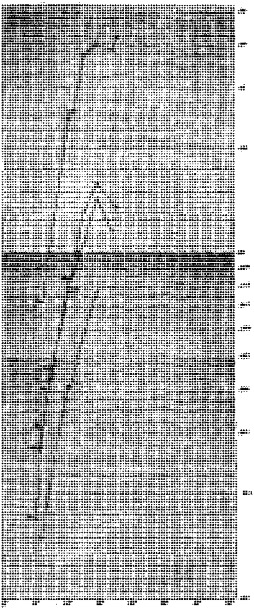

FIG. 40. Effect of temperature on rate of development. W_2 represents the period *in the second molting web; 4th, the fourth instar; 5th, the fifth* instar; t, the total feeding period. The data are the same as those used in making the B curves in figures 36 to 39 but the plotting paper is arith-*logarithmic, and no attempt has been made to smooth the curves. This* figure shows the comparative effect of temperature for the different stages.

ture is lethal if continuous, this cannot be considered a physiological zero.

Fluctuations in temperature have their greatest effect on the growth of the larvae when they occur around 21° to 25°.

The temperature characteristic (critical thermal increment) calculated according to the Arrhenius formula is not constant but

steadily declines in value as the temperature increases. This temperature characteristic is not the same for the quiescent pre-molting period as for the feeding period, and the rate of its change with changing temperature is also different.

TABLE 4. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926

Time in Second Molting Web

Larva No.	Temp. (C.)	Entered web (date)	Hours in web
164	12° (c)	9-21-26	178
165		9-18-26	130
167		9-17-26	136
169		9-24-26	128
170		9-21-26	111
173		9-19-26	138
Mean			137 (20)
251	14° (d)	9-23-26	96
254		9-22-26	112
255		9-23-26	100
256		9-22-26	101
257		9-24-26	95
258		9-22-26	103
259		9-22-26	95
260		9-25-26	104
Mean			101 (5)
122	20° (e)	9-12-26	39
125		9-13-26	54
127		9-12-26	39
128		9-13-26	47
226		9-14-26	41
235		9-12-26	39
131		9- 7-26	40
132		9- 7-26	42
133		9- 6-26	32
134		9- 8-26	39
Mean			41 (5)
123	21° (e)	9-12-26	47
129		9-12-26	33
135		9- 8-26	48
136		9- 7-26	40
137		9- 8-26	48
228		9-11-26	23
229		9-10-26	40
230		9-11-26	23
231		9-11-26	39
232		9-11-26	39
233		9-11-26	39
234		9-13-26	38
281		9-20-26	42
282		9-21-26	40
283		9-21-26	40
285		9-22-26	32
286		9-21-26	40

TABLE 4. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926—*Concluded*

Time in Second Molting Web—*Concluded*

Larva No.	Temp. (C.)	Entered web (date)	Hours in web
287		9-20-26	49
288		9-21-26	40
289		9-20-26	49
Mean			39 (7)
237	22° (e)	9-23-26	34
238		9-23-26	42
239		9-24-26	39
240		9-24-26	40
Mean			39 (3)
110	25° (f)	9- 5-26	31
111		9- 4-26	32
112		9- 5-26	15
113		9- 5-26	28
114		9- 5-26	28
115		9- 6-26	33
116		9- 5-26	30
118		9- 5-26	22
119		9- 4-26	25
120		9- 4-26	25
121		9- 5-26	28
Mean			27 (5)
155	29° (g)	9- 9-26	23
156		9 -9-26	25
158		9- 9-26	25
159		9-10-26	25
160		9- 9-26	23
161		9- 9-26	31
162		9-10-26	24
163		9- 9-26	25
Mean			25 (2)
261	34° (h)	9-17-26	23
262		9-17-26	23
265		9-17-26	33
270		9-17-26	23
Mean			26 (4)
263	35° (h)	9-16-26	24
264		9-17-26	24
266		9-17-26	24
268		9-16-26	24
Mean			24 (0)

TABLE 5. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926

Duration of Fourth Instar

Larva No.	Temp. (C.)	First molt web vacated (date)	Duration of instar (hours)
164	11° (c)	9- 9-26	465
165		9- 7-26	381
166		9- 9-26	343
167		9- 9-26	359

TABLE 5. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926—*Continued*

Duration of Fourth Instar—*Continued*

Larva No.	Temp. (C.)	First molt web vacated (date)	Duration of instar (hours)
168		9- 8-26	319
173		9-11-26	345
Mean			369 (47)
251	14° (d)	9-18-26	231
252		9-15-26	239
253		9-15-26	217
254		9-15-26	281
255		9-17-26	263
256		9-17-26	225
257		9-18-26	240
258		9-15-26	264
259		9-16-26	255
260		9-17-26	281
Mean			250 (21
128	20° (e)	9- 9-26	144
131		9- 4-26	105
132		9- 3-26	143
133		9- 3-26	111
136		9- 4-26	120
281		9-18-26	105
Mean			121 (16)
122	21° (e)	9- 9-26	112
123		9- 9-26	134
124		9- 9-26	119
125		9- 9-26	158
126		9- 9-26	119
127		9- 9-26	112
129		9- 9-26	90
134		9- 4-26	135
135		9- 4-26	144
137		9- 4-26	144
226		9- 9-26	161
228		9- 8-26	81
229		9- 8-26	81
230		9- 8-26	81
231		9- 8-26	97
232		9- 8-26	97
233		9- 8-26	97
234		9- 8-26	144
235		9- 9-26	105
237		9-20-26	106
238		9-21-26	105
239		9-21-26	111
240		9-20-26	145
282		9-18-26	113
283		9-18-26	113
285		9-18-26	130
286		9-18-26	120
287		9-18-26	118
288		9-18-26	113
289		9-17-26	118
Mean			117 (21)

TABLE 5. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926—*Concluded*

Duration of Fourth Instar—*Concluded*

Larva No.	Temp. (C.)	First molt web vacated (date)	Duration of instar (hours)
110	25° (f)	9- 3-26	85
111		9- 2-26	76
112		9- 2-26	69
113		9- 3-26	77
114		9- 3-26	77
115		9- 3-26	94
116		9- 3-26	79
117		9- 3-26	79
118		9- 3-26	71
119		9- 3-26	64
120		9- 3-26	64
121		9- 3-26	75
Mean			76 (8)
154	29° (g)	9- 7-26	71
155		9- 8-26	55
157		9- 8-26	48
158		9- 8-26	55
159		9- 8-26	80
160		9- 8-26	55
161		9- 7-26	71
162		9- 7-26	80
163		9- 8-26	56
Mean			63 (11)
261	35° (h)	9-15-26	77
262		9-15-26	77
263		9-15-26	62
264		9-15-26	63
265		9-15-26	95
266		9-15-26	79
268		9-15-26	62
270		9-15-26	77
Mean			74 (11)

TABLE 6. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926

Duration of Fifth Instar

Larva No.	Temp. (C.)	Second molt web vacated (date)	Duration of instar (hours)
531	10° (b)	9-23-26	567
533		9-24-26	452
534		9-28-26	738
536		9-25-26	587
537		9-24-26	604
Mean			590 (91)
164	12° (c)	9-28-26	249
165		9-23-26	239
167		9-24-26	285
168		9-21-26	388
169		9-30-26	486

TABLE 6. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926—*Continued*

Duration of Fifth Instar—Continued

Larva No.	Temp. (C.)	Second molt web vacated (date)	Duration of instar (hours)
170		9-25-26	278
173		9-25-26	284
542		9-25-26	357
543		9-25-26	339
544		9-24-26	259
545		9-24-26	250
546		9-23-26	379
547		9-26-26	403
549		9-23-26	267
550		9-23-26	311
Mean			*319 (69)*
251	15° (d)	9-27-26	220
254		9-27-26	226
255		9-28-26	211
257		9-28-26	187
258		9-26-26	213
259		9-26-26	229
260		9-29-26	242
Mean			*218 (16)*
123	20° (e)	9-14-26	120
124		9-14-26	135
126		9-14-26	135
127		9-14-26	152
129		9-13-26	150
230		9-12-26	104
235		9-14-26	107
Mean			*129 (18)*
122	21° (e)	9-14-26	104
125		9-15-26	120
128		9-15-26	120
131		9- 9-26	115
132		9- 9-26	126
133		9- 7-26	153
134		9- 9-26	93
135		9-10-26	159
136		9- 9-26	135
137		9-10-26	92
226		9-16-26	123
228		9-12-26	135
231		9-12-26	123
232		9-12-26	99
233		9-12-26	99
234		9-14-26	148
237		9-25-26	115
238		9-25-26	170
239		9-25-26	153
240		9-26-26	122
281		9-22-26	129
283		9-23-26	131
285		9-24-26	126
286		9-23-26	94

TABLE 6. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926—*Concluded*

Duration of Fifth Instar—*Concluded*

Larva No.	Temp. (C.)	Second molt web vacated (date)	Duration of instar (hours)
287		9-22-26	115
288		9-23-26	114
291		9-20-26	91
293		9-20-26	120
294		9-20-26	97
295		9-21-26	120
296		9-20-26	97
297		9-20-26	86
298		9-20-26	112
299		9-19-26	104
300		9-20-26	104
551		9-24-26	146
552		9-23-26	99
553		9-23-26	175
554		9-23-26	112
555		9-24-26	116
556		9-23-26	156
557		9-24-26	104
558		9-24-26	178
559		9-23-26	99
Mean			121 (24)
110	25° (f)	9- 7-26	92
111		9- 6-26	97
115		9- 7-26	97
116		9- 6-26	108
117		9- 6-26	80
118		9- 6-26	88
119		9- 5-26	133
120		9- 5-26	75
121		9- 6-26	72
Mean			94 (18)
155	29° (g)	9-10-26	77
156		9-10-26	55
157		9-10-26	80
158		9-10-26	55
159		9-11-26	82
160		9-10-26	81
161		9-10-26	65
163		9-10-26	65
Mean			70 (11)
526	34° (h)	9-22-26	90
527		9-23-26	91
528		9-23-26	96
529		9-24-26	66
530		9-23-26	86
Mean			86 (10)

TABLE 7. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926

Duration of External Feeding Period

Larva No.	Temp. (C.)	First molt web vacated (date)	Duration of period (hours)
164	12° (c)	9- 9-26	714
167		9- 9-26	644
168		9- 8-26	707
169		9- 9-26	803
170		9-11-26	629
173		9-11-26	629
Mean			688 (62)
251	14° (d)	9-18-26	451
252		9-15-26	476
253		9-15-26	456
254		9-15-26	507
257		9-18-26	427
258		9-15-26	477
259		9-16-26	484
260		9-17-26	523
Mean			475 (29)
230	20° (e)	9- 8-26	185
127		9- 9-26	264
128		9- 9-26	264
129		9- 9-26	240
132		9- 3-26	269
Mean			244 (31)
122	21° (e)	9- 9-26	216
123		9- 9-26	254
124		9- 9-26	254
125		9- 9-26	278
126		9- 9-26	254
131		9- 4-26	220
133		9- 3-26	264
134		9- 4-26	228
135		9- 4-26	303
136		9- 4-26	255
137		9- 4-26	236
226		9- 9-26	284
228		9- 8-26	216
231		9- 8-26	220
232		9- 8-26	196
233		9- 8-26	196
234		9- 8-26	292
235		9- 9-26	212
237		9-20-26	221
238		9-21-26	275
239		9-21-26	264
240		9-20-26	267
281		9-18-26	234
283		9-18-26	244
285		9-18-26	256
286		9-18-26	214
287		9-17-26	233
288		9-18-26	227
Mean			243 (28)

TABLE 7. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926—*Concluded*

Duration of External Feeding Period—*Concluded*

Larva No.	Temp. (C.)	First molt web vacated (date)	Duration of period (hours)
110	25° (f)	9- 3-26	177
111		9- 2-26	173
115		9- 3-26	191
116		9- 3-26	187
117		9- 3-26	159
118		9- 3-26	159
119		9- 3-26	197
120		9- 3-26	139
121		9- 3-26	147
Mean			170 (19)
155	29° (g)	9- 8-26	132
156		9- 7-26	118
157		9- 8-26	128
158		9- 8-26	110
159		9- 8-26	162
160		9- 8-26	136
161		9- 7-26	136
163		9- 8-26	121
Mean			130 (14)

TABLE 8. EFFECT OF TEMPERATURE ON DEVELOPMENT, 1926

Duration of Quiescent Period in Second Molting Web

Number of Larvae	Temperature (C.)	Average Time in Web (hours)	Standard Deviation (hours)	Index of Development	Tangent to Curve B
6	12°	137± 5.6	20	.0072	
8	14	101± 1.2	5	.0099	.6770
10	20	41± 1.1	5	.0244	1.3100
20	21	39± 1.0	7	.0256	1.7100
4	22	39± 1.0	3	.0256	1.8855
11	25	27± 1.0	5	.0370	1.2800
8	29	25± 0.5	2	.0400	.8350
4	34	26± 1.4	4	.0385	
4	35	24± 0	0	.0417	.7700

Duration of Fourth Instar

Number of Larvae	Temperature (C.)	Average Duration of Instar (hours)	Standard Deviation (hours)	Index of Development	Tangent to Curve B
6	11°	369±13.2	47	.0027	
10	14	250± 4.4	21	.0040	.2395
6	20	121± 4.5	16	.0083	.4215
30	21	117± 2.6	21	.0085	.4275
12	25	76± 1.5	8	.0132	.6265
9	29	63± 2.5	11	.0159	.1240
8	35	74± 2.6	11	.0135	.3860

Duration of Fifth Instar

Number of Larvae	Temperature (C.)	Average Duration of Instar (hours)	Standard Deviation (hours)	Index of Development	Tangent to Curve B
5	10°	590±27.4	91	.0017	
15	12	319±12.0	69	.0031	.2885
7	15	218± 4.1	16	.0046	.2610
7	20	129± 4.6	18	.0077	.3580
44	21	121± 2.4	24	.0083	.3725
9	25	94± 4.0	18	.0106	.4280
8	29	70± 2.6	11	.0143	.2935
5	34	86± 3.0	10	.0116	.5956

Duration of External Feeding Period

Number of Larvae	Temperature (C.)	Average Duration of Period (hours)	Standard Deviation (hours)	Index of Development	Tangent to Curve B
6	12°	688±17	62	.0015	
8	14	475± 6.9	29	.0021	.1515
5	20	244± 9.3	31	.0041	.1760
28	21	243± 3.6	28	.0041	.1895
9	25	170± 4.3	19	.0059	.2235
8	29	130± 3.3	14	.0077	.1855

XII. Control

The control of these larvae is a very simple matter on ornamental trees. The trees should be sprayed about the middle of August with lead arsenate at the rate of 3 pounds of powder to 100 gallons of water. Add one pound of casein-lime to aid in spreading the poison and making it adhere to the foliage. The larvae feed on the lower side of the leaves, and this side must be covered with the arsenate. Experiments conducted by the writer have shown that if the trees are carefully sprayed there will be practically no feeding by the insects.

XIII. Summary

The history of the genus *Bucculatrix* up to the description of the species *canadensisella* Chambers has been briefly reviewed, and an account has been given of the periodic abundance of this species in North America up to the present. Systematically the genus is usually placed in the family Lyonetiidae.

A brief description is given of the external morphology of the different stages.

There is but one generation a year of *B. canadensisella*. The adults emerge from the cocoons in June and July and oviposit on the leaves of birches. The incubation period of the eggs averages 15 days. The larvae mine in the leaf during the first three instars, the mining period averaging between 24 and 31 days. The last two instars feed externally on the under side of the leaf,

skeletonizing it, and this feeding period averages from 13 to 15 days. The total larval life averages from 38 to 46 days. The cocoon is spun on the under side of debris on the ground, and hibernation occurs in the pupal stage. The last larvae are found in the field the latter part of September. There are five larval instars.

The number of larval instars was determined by applying Dyar's hypothesis to the width of the head capsules.

The principal larval food plants are the gray, paper, yellow, and European white birches. Some feeding on black birch has been observed.

The Hymenopterous parasites, of which ten species have been reared, and the ants and other predaceous foes are the principal factors affecting the abundance of this insect.

The geographical range includes southern Canada and northern United States, the insect being particularly abundant around the Great Lakes and east to the Atlantic Ocean.

Temperature has a marked influence on the development of the larvae. At 10°C and lower, and at 34°C. and higher, they cannot survive. The curve obtained by plotting rate of development (reciprocal of hours taken to complete a given stage) against temperature is sigmoid. Above 30° temperature has a depressing effect. An absolute physiological zero was not obtained because of the ability of the larvae to develop slightly at a low temperature which was fatal if continued a sufficient length of time. There is no thermal constant for any temperature range beyond the experimental error, and the temperature characteristic as computed by the Arrhenius formula steadily decreases in magnitude as the temperature increases.

The use of a lead arsenate spray about the middle of August will protect the trees against injury by the larvae.

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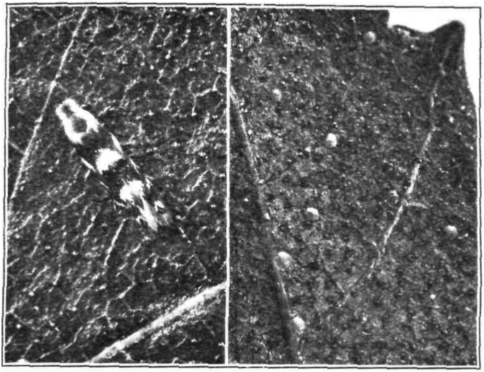
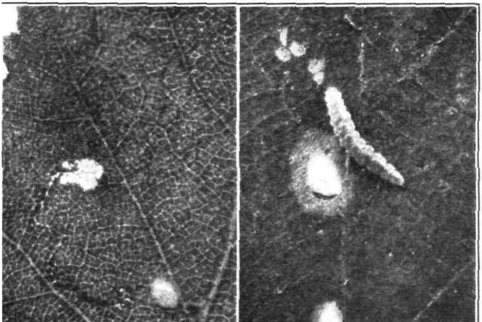
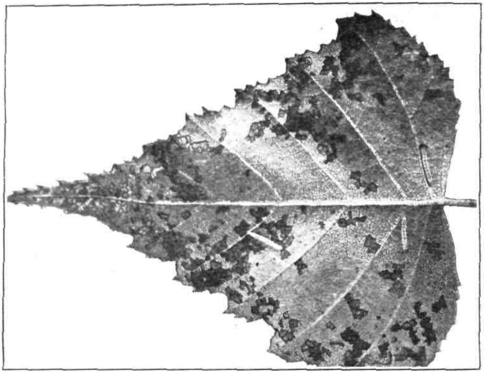


a. Adult (left) and eggs (right) of *Bucculatrix canadensisella* on birch aves. Adult enlarged eight times, eggs enlarged ten times.

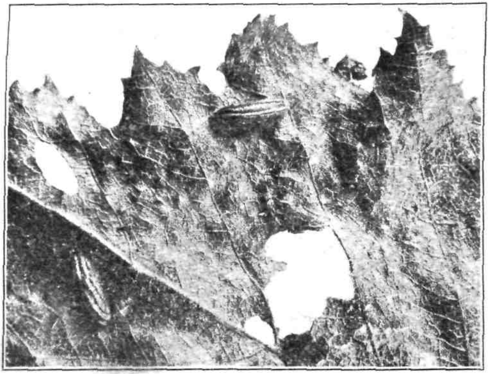


b. Vacant mine of larva in birch leaf (left) and fully grown larva right) with first (lower) and second (upper) vacant molting webs. nlarged four times.

BIRCH LEAF SKELETONIZER



a. Larva of *Bucculatrix canadensisella* skeletonizing leaf of gray birch. Slightly enlarged.



b. Cocoons of *Bucculatrix canadensisella* on dead leaf. Enlarged four times.

BIRCH LEAF SKELETONIZER

BULLETIN 289 AUGUST, 1927

Connecticut Agricultural Experiment Station

New Haven, Connecticut

REPORT ON INSPECTION

OF

COMMERCIAL FEEDING STUFFS

1926-1927

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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as of

August, 1927

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THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

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CHANGE IN REGISTRATION DATE.

The law relating to Commercial Feeding Stuffs has been revised so that beginning January 1st, 1928, registrations will be required annually by calendar years. Heretofore the registration period has been from September 1st to August 31st of the following year. *All registrations of record with this* Station for the present year ending August 31st will be held to be in force until January 1st, 1928, at which time renewals are required.

COMMERCIAL FEEDING STUFFS

E. M. Bailey.*

The Feed Law.

The text of the law relating to concentrated commercial feeding stuffs and of regulations made jointly by the Dairy and Food Commissioner and the Director of this Station for carrying out its provisions, are given in a special bulletin[1] recently issued.

Some essential provisions of the law and the regulations may be briefly restated here.

Exemptions. It is held that the law exempts from classification as concentrated commercial feeding stuffs, and therefore from registration, (1) roughages such as hays, straws, corn stover, ensilage and all materials containing over 60 per cent of water; (2) whole grains and mixtures thereof; (3) meals made from whole grains when not mixed with other materials or with each other; (4) feed ground from whole grains and sold by the manufacturer directly to the consumer; (5) feed ground from materials furnished by the consumer; or (6) feed mixed according to a formula furnished by the consumer, for his own use.

Under the provision of clause 6 above, a feed must be sold as a formula only, without a private brand name and without analysis. But a feed cannot be offered for general trade as a formula in order to avoid registration and the registration fee.

Labelling. All concentrated commercial feeding stuffs must be labelled either by a statement printed on the bag or upon a properly attached tag; except that in the case of cottonseed meal sold for fertilizer, or of any concentrated feeding stuff sold in bulk, a certificate which shall contain the information otherwise required to appear upon the bag or upon the tag, may be issued by the dealer in lieu thereof.

The law requires a statement of (1) the net weight of the feed contained in the package; (2) the name, brand or trademark under which the feed is sold; (3) name and address of the manufacturer or importer; (4) the minimum percentages of (a) crude protein and (b) crude fat, and the maximum percentage of (c) crude fiber contained in the feed; and (5) the separate ingredients of which the feed is composed.

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* Analyses were made by Messrs. Nolan, Mathis and Walden; microscopic examinations by Mr. Shepard; inspection and sampling by Mr. Churchill; and the compilations largely by Miss Bacon.

[1] Bull. Immediate Information No. 60, June, 1927.

While the law requires only a statement of the items enumerated above no objection will be raised to more complete statements of chemical composition.

Affixing tags. The use of wire or any metal in affixing tags to feed packages is prohibited by law.

Registration and registration fee. The law requires an annual registration of all concentrated feeds sold or offered for sale in this State. Registrations are to be made with the Connecticut Agricultural Experiment Station and beginning January 1st, 1928, the registration period is for the duration of the calendar year. The registration fee is fifteen dollars ($15.00), for each brand, a distinct brand name or a distinct analysis constituting a distinct brand.

Duties of manufacturers, jobbers and dealers. All concentrated commercial feeding stuffs must be registered annually on January 1st, or before they are offered for sale.

Manufacturers, jobbers or individuals shipping feeds into Connecticut will be expected to register their brands and pay the necessary fees thereon. Connecticut dealers should assure themselves that the brands they handle are properly registered and labelled. In case the manufacturer or jobber outside the State neglects or refuses to register, the dealer who handles such feeds will be held responsible for such registrations, registration fees and other legal requirements.

Dealers within the State who mix their own brands are responsible for the registration and proper labelling thereof.

Cottonseed meal. Cottonseed meal sold as a fertilizer is required to be registered under the terms of the fertilizer law; if sold also as a feeding stuff it is required also to be registered under the provisions of the feed law; if sold exclusively for one or the other of these purposes, it may be registered only under that law which applies.

Explanation of Terms Used in an Analysis of Feeding Stuff.

In registering feeding stuffs the law requires that the minimum percentages of crude protein and crude fat, and the maximum percentage of crude fiber, shall be given; that is, the registrant must guarantee that the feeds registered will contain *not less* than the stated percentages of crude protein and of crude fat and *not more* than the stated percentage of crude fiber.

The term *crude protein* denotes those nutrients which contain nitrogen, and is obtained by multiplying the percentage of total nitrogen in the feed by the factor 6.25.

The term *crude fat* denotes those substances which are soluble in ether and includes, besides fat, such non-fatty materials as chlorophyll and coloring matter.

The term *crude fiber* denotes the coarse, woody tissues characteristic of all forms of roughage and which are present in the outer coats of cereal and other fodder grains.

While the law requires only a statement of the three nutrients just defined, no objection is taken to more complete statements of composition, but such further statements, if given, must be correct. Thus, tags sometimes bear guaranties for nitrogen-free-extract and for carbohydrates.

The term *nitrogen-free-extract* denotes those nutrients of the starch and the sugar types. This group is never determined directly but is obtained by subtracting from 100 per cent the sum of the percentages of moisture, ash, crude protein, crude fiber and crude fat.

The term *carbohydrates* denotes the combined percentages of crude fiber and nitrogen-free-extract.

Registrations.

(Late Registrations for the period September 1st, 1925, to August 31st, 1926.)

To the brands registered for 1925 in our last report should be added:

American Milling Co., Peoria, Ill.

Amco Chick Grains
Amco Egg Mash
Amco Egg Mash with Buttermilk
Amco Egg Mash with Meat Scraps
Amco Scratch Grains
Amco Starting and Growing Mash
Amco 12% Fitting Ration
Sucrene Calf Meal
Sucrene Scratch Feed

Archer-Daniels Midland Co., Minneapolis, Minn.

Pure Old Process Linseed Meal

Beacon Milling Co., Inc., Cayuga, N. Y.

Beacon Chick Feed
Beacon Developer Feed
Beacon Growing Mash
Beacon Hog Feed
Beacon Starting Feed
Cayuga Laying Mash with Buttermilk
Chariot Chick Feed
Chariot Developer Feed

The Coles Co., Middletown, Conn.

Fortune Chick Feed
Fortune Egg Mash
Fortune Growing Feed
Fortune Scratch
Fortune Stock Feed

Chapin & Co., 327 South LaSalle St., Chicago, Ill.
Ajax Dairy Ration
Green Diamond Cottonseed Meal
Unicorn Scratch Feed

Dietrich & Gambrill, Inc., Frederick, Md.
D & G Dairy Feed
Gambrill's Dairy Feed
Gambrill's Horse Feed

John W. Eshelman & Sons, Lancaster, Pa.
Eshelman's Growing Mash
Eshelman's Liberty Horse Feed
Eshelman's Pennsy 16 Dairy Feed

Hecker H-O Co., Inc., Buffalo, N. Y.
Re-Ground Oat Feed

R. H. Holcomb, Newtown, Conn.
Holcomb's Special Dairy Ration

Hudson Feed & Grain Co., Windsor, Conn.
Hudson Developing Mash

L. B. Lovitt & Co., Memphis, Tenn.
"Lovit *Brand*" 36% Cottonseed Meal
"Lovit Brand" 41% Cottonseed Meal
"Lovit Brand" 43% Cottonseed Meal

The Mann Bros. Co., Buffalo, N. Y.
31% Protein Pure Old Process Linseed Meal

Maritime Milling Co., Inc., Buffalo, N. Y.
Bull Brand Developing Feed
Bull Brand Growing Mash (with Dried Buttermilk)

Niagara Falls Milling Co., Niagara Falls, N. Y.
Niagara Choice Wheat Bran
Niagara Choice Wheat Flour Middlings
Niagara Choice Wheat Mixed Feed

W. N. Potter & Sons, Inc., Greenfield, Mass.
A. D. P. 24% Dairy Ration
Puritan Dry Mash

Ralston Purina Co., St. Louis, Mo.
Purina Bulky Las Feed
Purina Chick Growena Feed
Purina Chick Startena Feed containing Buttermilk
Purina Pigeon Chow Feed
Purina Pigeon Chow Feed containing Corn

St. Albans Grain Co., St. Albans, Vt.
Franklin Pasture Ration containing Minerals
King Baby Chick Food
King Growing Feed containing Dried Buttermilk and Beef Scraps
King Intermediate Chick Feed
King 22 Protein Milk Ration
Wirthmore Hog Feed
Wirthmore Pig Feed

Syracuse Milling Co., Syracuse, N. Y.
Jordan Molasses Horse Feed
Jordan Sweet Dairy Feed
Syragold Molasses Horse Feed

D. L. Talcott, Litchfield, Conn.
Economy Dairy Ration

Thomaston Supply Co., Inc., Thomaston, Conn.
Thomaston Dairy Ration
Thomaston Egg Mash
Thomaston Scratch Feed

Tioga Mill & Elevator Co., Waverly, N. Y.
Chicatine
Colonel's Ration
Or-Co Feed
Red Brand Tioga Dairy Feed
Tioga Calf Food
Tioga Chick Feed
Tioga Poultry Grain
White Brand Tioga Dairy Feed

United Flour & Feed Co., Inc., Albany, N. Y.
Chicklet Chick Feed
Chick Starter Feed

(For the period September 1st, 1926, to August 31st, 1927.)

One hundred and seventy-seven firms and individuals have registered 793 brands of feeding stuffs. As required by Statute these registrations are listed as follows:

C. L. Adams Co., Woodbury, Conn.
Claco

E. T. Allen Co., Atlanta, Ga.
Empire-High Grade Cottonseed Meal
Premier-Choice Cottonseed Meal

American Agricultural Chemical Co., New Haven Sales Dept., New Haven, Conn.
"Capital Meat and Bone Scrap"
"Protox Meat and Bone Scrap"

American Linseed Co., N. Y.
Old Process Flaxseed Screenings Oil Feed

American Maize-Products Co., 41 East 42d St., New York, N. Y.
Cream of Corn Gluten Feed

American Milling Co., Peoria, Ill.
Alfalfa Meal
Amco Arab Horse Feed
Amco Calf Meal
Amco Egg Mash
Amco Egg Mash with Dried Buttermilk
Amco Horse Feed

Amco June Pasture Alfalfa and Molasses
Amco Laying Mash with Alfalfa Leaf Meal
Amco Old Process Linseed Meal
Amco Provender Pure Ground Corn and Oats ½ and ½
Amco 16½% Sucrene Dairy Ration
Amco Scratch Grains (No. 1 Formula)
Amco Starting and Growing Mash with Dried Buttermilk
Amco 12% Fitting Ration
Amco 20% Dairy Ration (Flexible Formula)
Amco 20% Empire
Amco 20% National Dairy Ration
Amco 24% Batch Mix
Amco 24% Dairy Ration (Flexible Formula)
Amco 24% Universal

Apothecaries Hall Co., Waterbury, Conn.
Sterilized Steamed Bone

Arcady Farms Milling Co., Chicago, Ill.
Advanced Registry Dairy Feed
Arcady Besbet Laying Mash
Arcady Scratch Grains
Arcady Stock Feed
Arcady 32 Dairy Feed
Milkers' Ready Ration
Peerless Milk Ration
Sweet 16 Dairy Feed
Wonder Dairy Ration
Wonder Horse Feed
Wonder Laying Mash

Archer-Daniels Midland Co., Minneapolis, Minn.
Pure Old Process Linseed Meal 32%
Pure Old Process Linseed Meal 34%

Ashcraft-Wilkinson Co., Atlanta, Ga.
Helmet Brand Cottonseed Meal
Monarch Brand Cottonseed Meal
Paramount Brand Cottonseed Meal

Atlan Mfg. Co., Jersey City, N. J.
Atlan's Diamond Pick Meat and Bone Scraps

E. W. Bailey & Co., Montpelier, Vt.
Bailey's Fancy Winter Mixed Feed
Bailey's Open Formula 20% Dairy Feed
Bailey's Open Formula 24% Dairy Feed
Capital Dairy Ration
Capital Mixed Feed
Favorite Dairy Ration
"Our Own" Dairy Ration
Pennant Scratch Feed
Pennant Stock Feed

H. J. Baker & Bro., N. Y.
Baker Brand Dried Beet Pulp

Bay State Milling Co., Winona, Minn.

Wingold Pure Hard Wheat Bran
Wingold Diamond "G" Pure Hard Wheat Red Dog
Wingold Fancy Pure Hard Wheat Mixed Wheat Feed
Wingold Pure Hard Wheat Fancy White Flour Middlings
Wingold Standard Hard Wheat Middlings and Wheat Screenings
Wingold Rye Middlings and Rye Screenings

Beach Soap Co., Lawrence, Mass.

Beach's Star Brand Beef Scraps

Beacon Milling Co., Inc., Cayuga, N. Y.

Auburn Dairy Feed
Auburn Scratch Feed
Beacon Breeders Mash with Buttermilk
Beacon Calf Meal
Beacon Chick Feed
Beacon Dairy Ration
Beacon Developer Feed
Beacon Egg Mash with Buttermilk
Beacon Growing Mash
Beacon Horse Feed
Beacon Laying Mash
Beacon Pigeon Feed
Beacon Scratch Grains
Beacon Special Scratch Grains
Beacon Starting Mash
Beacon "20"
Cayuga Laying Mash with Buttermilk
Cayuga Scratch Feed
Cayuga Stock Feed
Chariot Chick Feed
Chariot Developer Feed

Ira W. Beers, Hamden, Conn.

Beers Dairy Ration
Beers Laying Mash
Beers Scratch Feed

A. A. Beltz, Minneapolis, Minn.

A-A Pure Wheat Bran

Blatchford Calf Meal Co., Waukegan, Ill.

Blatchford's Calf Meal
Blatchford's Chick Mash

Amos D. Bridge's Sons, Inc., Hazardville, Conn.

Success Dairy Ration

F. W. Brode Corp., Memphis, Tenn.

Owl Brand 41% Prime Cottonseed Meal
Owl Brand 43% Prime Cottonseed Meal
Owl Brand 36% Prime Cottonseed Meal

Buckeye Cotton Oil Co., Cincinnati, Ohio.

Buckeye Prime 41% Cottonseed Meal

C. Buckingham & Co., Southport, Conn.
Buckingham's Dry Mash
C. B. Dairy Feed

C. E. Buell, Inc., Boston, Mass.
Buell Boston Dried Skim Milk

Camilla Cotton Oil Co., Camilla, Ga.
Micoga Brand Good Cottonseed Meal
Micoga Brand High Grade Cottonseed Meal

C. W. Campbell Co., Stonington, Conn.
Egg-O Dry Mash
Egg-O Scratch Feed
No-Botheration Dairy Ration
Provender

The Canada Linseed Oil Mills, Ltd., Montreal, Canada.
"Maple Leaf" Brand Linseed Oilcake Meal

Cereal Mills Co., Wausau, Wis.
Hominy Feed

Chapin & Co., 327 South LaSalle St., Chicago, Ill.
Ajax Dairy Ration—20%
Ajax Dairy Ration—24%
Green Diamond Cottonseed Meal
Unicorn Dairy Ration
Unicorn Horse Feed
Unicorn Scratch Feed

Clinton Corn Syrup Refining Co., Clinton, Iowa.
Clinton Corn Gluten Feed

The Coles Co., Middletown, Conn.
Albert Angell Jr.'s Chick Starter
Albert Angell Jr.'s Coarse Chick Scratch
Albert Angell Jr.'s Egg Mash
Albert Angell Jr.'s Fine Chick Scratch
Albert Angell Jr.'s Growing Mash
Albert Angell Jr.'s Scratch Feed
Fortune Egg Mash with Dried Buttermilk
Fortune Growing Feed
Fortune Intermediate Scratch
Fortune Scratch Feed
Fortune Stock Feed
20% Dairy Ration
24% Dairy Ration

Collis Products Co., Clinton, Iowa.
Collis Process Pure Dried Buttermilk

The G. E. Conkey Co., Cleveland, Ohio.
Conkey's Buttermilk Grain and Bone Starting Feed
Conkey's Buttermilk Meat, Grain and Bone Growing Mash
Conkey's Buttermilk Meat, Grain and Bone Laying Mash

Conkey's Chick Grains
Conkey's Dairy Ration
Conkey's Gecco Egg Mash
Conkey's Growing Grains
Conkey's Scratch Grains
Conkey's Pigeon Feed (Breeders)
Conkey's Pigeon Feed (Flyers)
Gecco Chick Grains
Gecco Dairy Ration
Gecco Growing Grains
Gecco Scratch Grains
Red Seal Dairy Ration
Red Seal Scratch Feed
Superior Scratch

Conn. Fat Rend. & Fertz. Corp., West Haven, Conn.
The Conn. Fat Rend. & Fertz. Corp. Meat Scrap 40%
The Conn. Fat Rend. & Fertz. Corp. Meat Scrap 50%

Copeland Flour Mills, Ltd., Midland, Ontario, Canada.
Copeland's Dandy Bran
Copeland's Dandy Shorts

Corn Products Refining Co., 17 Battery Place, New York, N. Y.
Buffalo Corn Gluten Feed
Co-Pro-Co Horse and Mule Feed
Diamond Corn Gluten Meal

C. A. Cowles, Plantsville, Conn.
C. A. Blue Seal Mash
Cowles' Scratch Feed
Cowles' 24% Dairy Ration

Chas. M. Cox, Boston, Mass.
Lakewoods Pure Standard Middlings (Lake of the Woods Milling Co., Ltd., Montreal)
Lakewoods Wheat Bran (Lake of the Woods Milling Co., Ltd., Montreal)
Pioneer Pure Wheat Bran (Western Canada Flour Mills, Ltd., Toronto, Ont.)
Pioneer Shorts (Western Canada Flour Mills, Ltd., Toronto, Ont.)
Rex Wheat Middlings (Maple Leaf Milling Co.)
Wheat Bran (Maple Leaf Milling Co.)

Crosby Milling Co., Brattleboro, Vt.
Crosby's Balanced Ration
Crosby's 22% Dairy Feed
Crosby's Egg Mash Feed
Crosby's Ready Ration
Crosby's Scratch Feed
Crosby's Stock Feed

R. G. Davis & Sons, Inc., New Haven, Conn.
Basic Dairy Ration
Davis Horse Feed
Davis Mash Feed
Davis No. 1 Provender
Davis Stock Feed
Davis Scratch Feed

S. P. Davis, Little Rock, Ark.
- Beauty Brand 36% Protein C/S Meal
- Goodluck Brand 41% Protein C/S Meal
- Steerboy Brand 43% Protein C/S Meal

Decatur Milling Co., Decatur, Ill.
- Homco Brand Hominy Feed

Delaware Mills, Inc., Deposit, N. Y.
- Delaware Chick Starting Mash (with Dried Buttermilk)
- Delaware Dairy Feed
- Delaware Growing Mash (with Dried Buttermilk)
- Delaware Laying Mash
- Delaware Scratch Grains
- Delaware Stock Feed
- Indian Laying Mash
- Indian Scratch Grains

Denver Alfalfa Milling & Products Co., Lamar, Colo.
- Alfalfa Meal
- Alfalfa Leaf Meal (Leafalfa Brand)

The Devon Coal & Ice Co., Devon, Conn.
- Devon Dairy Ration
- Devon Laying Mash
- Devon Sweet Stock Feed

The Dewey Bros. Co., Blanchester, Ohio.
- Eagle 3D Grains, or Dewey's Distillers Dried Grains

Dietrich & Gambrill, Inc., Frederick, Md.
- D & G Dairy Feed
- D & G Stock Feed
- Frederick Horse Feed
- Frederick Laying Mash
- Gambrill's A1 Dairy Ration
- Gambrill's Dairy Feed
- Gambrill's Horse Feed
- Gambrill's Laying Mash
- Gambrill's Scratch Feed

Dominion Flour Mills, Montreal, Canada.
- Wheat Bran
- Wheat Shorts

Dry Milk Co., 15 Park Row, New York, N. Y.
- Chikora

Duluth-Superior Milling Co., 620 Board of Trade Bldg., Duluth, Minn.
- Boston Mixed Feed
- Duluth Imperial Wheat Bran

Eastern States Farmers' Exchange, 33 Lyman St., Springfield, Mass.
- Eastern States Buttermilk Egg Mash
- E. S. Egg Mash
- Eastern States Fitting Ration
- Eastern States Fulpail Dairy Ration
- Eastern States Milkmore Dairy Ration
- E. S. Scratch Grains

Elevator Milling Co., Springfield, Mass.
Ideal White Hominy Feed

Elmore Milling Co., Inc., Oneonta, N. Y.
Elmore Baby Chick Mash with Dried Buttermilk
Elmore Calf Meal
Elmore Egg Mash
Elmore Growing Mash
Elmore Horse Feed with Molasses
Elmore Milk Grains
Elmore Poultry Mash with Buttermilk
Elmore's Red Dog Flour Middlings
Elmore (Storrs Formula) Laying Mash
Elmore Scratch Feed
Elmore Snow Middlings
Elmore Stock Feed
Emco Feed
Emco Scratch Feed

John W. Eshelman & Sons, Lancaster, Pa.
Eshelman's Baby Chick Starter
Eshelman's Chick Feed
Eshelman's Conestoga 18 Dairy Feed
Eshelman's Garden Spot Horse Feed
Eshelman's Golden Rod 25% Dairy Feed
Eshelman's Growing Mash
Eshelman's Lancaster 20 Dairy Feed
Eshelman's Lancaster 60 Horse Feed
Eshelman's Lancaster Stock Feed
Eshelman's Laying Mash
Eshelman's Liberty Horse Feed
Eshelman's Pennsy 16 Dairy Feed
Eshelman's Red Rose 24 Dairy Feed
Eshelman's Red Rose 85 Horse Feed
Eshelman's Scratch Feed
Eshelman's Stock Feed
Eshelman's Sugared Stock Feed
Eshelman's Susquehanna Dairy Feed
Eshelman's Thorobred Horse Feed
Eshelman's Wheat Flour Middlings
Imperial Scratch Feed
Pennsy Scratch Feed

Evans Milling Co., Indianapolis, Ind.
Emco Hominy Feed

Everett, Aughenbaugh & Co., Minneapolis, Minn.
E-A-CO Hard Wheat Mixed Feed
E-A-CO Pure Wheat Bran
E-A-CO Pure Wheat Flour Middlings
E-A-CO Standard Middlings

Fairchild Milling Co., Cleveland, Ohio.
Special Fine Wheat Middlings
Standard Middlings
Wheat Bran, with Gr. Screenings

Fairmont Creamery Co., Omaha, Neb.
Fairmont's Better Pure Flake Buttermilk

Farmers' Feed Co., New York, N. Y.

"Bull Brand" Dried Brewers Grains

Federal Mill & Elevator Co., Inc., Lockport, N. Y.

Dairy Maid Winter Wheat Middlings
Dairy Maid Winter Wheat Mixed Feed
Lucky Hard Wheat Bran
Sphinx Fancy Hard Wheat Flour Middlings

Flory Milling Co., Inc., Bangor, Pa.

Blue Mountain Horse Feed
Butterfat Dairy Feed
Flory's Baby Chick Feed
Flory's Chick Starter
Flory's Dairy Feed
Flory's Egg Mash
Flory's Growing Mash
Flory's Horse Feed
Flory's Intermediate Chick Feed
Flory's Pure Wheat Bran
Flory's Scratch Feed
Flory's Special Stock Feed
Golden Egg Laying Mash
Golden Egg Scratch Feed
National Cow Feed
Record Dairy Feed
Sunray Scratch Feed
Vio Horse Feed

A. W. Forbes, East Haven, Conn.

R OWN Dairy Ration
R OWN Laying Mash
R OWN Scratch Feed

L. T. Frisbie Co., New Haven, Conn.

Frisbie's Bone Meal 20/25% Protein (for cattle and poultry)
Frisbie's Bone and Meat Meal 35/45% Protein
Frisbie's Cracked Bone (for poultry)
Frisbie's Poultry Feed 45/55% Protein
Frisbie's Poultry Feed 55/65% Protein

Grain Belt Mills Co., South Saint Joseph, Mo.

Bronco Horse and Mule Feed

D. H. Grandin Milling Co., Jamestown, N. Y.

Grandin's Growing Feed
Grandin's Laying Mash with Buttermilk
Grandin's Screened Scratch Feed
Grandin's 12 Twin Six 12 Dairy Ration
Grandin's 24% Balanced Dairy Ration

Hales & Hunter Co., Chicago, Ill.

Cackle Scratch Feed, No Grit
Red Comb Egg Mash with Dried Buttermilk
Red Comb Scratch Feed, No Grit

Wm. Hamilton & Son, Inc., Caledonia, N. Y.

Wheat Bran
Wheat Middlings

The Hecker H-O Co., Inc., Buffalo, N. Y.

Algrane Horse Feed
Algrane Milk Feed
Algrane New England Stock Feed
Algrane Read The Tag Dairy Feed
Algrane Steam-Cooked Chick Feed
Re-Ground Oat Feed

Hecker-Jones-Jewell Milling Co., 40 Corlears St., New York, N. Y.

Choice Wheat Bran
H. Wheat Middlings
Red Dog Flour

(Buffalo Mill)

Choice Wheat Bran
Extra Heavy Wheat Mixed Feed
Wheat Flour Middlings
Wheat Red Dog Flour
Wheat Standard Middlings

J. C. Hubinger Bros. Co., Keokuk, Iowa.

Ke Ok Uk Corn Gluten Feed

L. W. Hudson, Windsor, Conn.

Hudson's Cow Feed
Hudson's Developing Mash
Hudson's Laying Mash

Humphreys-Godwin Co., Memphis, Tenn.

Bull Brand Cottonseed Meal
Dixie Brand Cottonseed Meal
Danish Brand Cottonseed Feed

Imperial Grain & Milling Co., Toledo, Ohio.

Imperial Steam Cooked Feed

Z. C. Ingersoll, Stratford, Conn.

Ingersoll's Special Egg Mash

International Agricultural Corp., Columbus, Ga.

International Rainbow—36% Brand Cottonseed Meal
International Rainbow—43% Brand Cottonseed Meal
Zenith 36% Brand Cottonseed Meal

International Milling Co., Minneapolis, Minn.

Blackhawk Pure Wheat Bran
Blackhawk Wheat Standard Middlings

International Sugar Feed Co., Minneapolis, Minn.

International Diamond Dairy Feed
International Ready Ration Dairy Feed
International Special Dairy Feed

Kansas Flour Mills Corp., Kansas City, Mo.

Big Flake Pure Wheat Bran

Kasco Mills, Inc., Waverly, N. Y.

Apex Milk Maker
Beatsall Milk Grains

Kellogg Co., Battle Creek, Mich.
Kellogg's Fine White Hominy

Kelloggs & Miller, Amsterdam, N. Y.
Old Process Linseed Oil Meal

Spencer Kellogg & Sons, Inc., Buffalo, N. Y.
"Kellogg's Pure Old Process Linseed Meal"

Keno Feed & Grain Corp., Buffalo, N. Y.
Buffalo Corn Feed Meal

H. H. King Flour Mills Co., Minneapolis, Minn.
"Gold Mine" Feed

Chas. A. Krause Milling Co., Milwaukee, Wis.
Badger Stock Feed
Sugared Badger Stock Feed

S. F. Labieniac, Kensington, Conn.
Dry Mash

The Larabee Flour Mills Co., Kansas City, Mo.
Wheat Bran and Wheat Screenings

The Larrowe Milling Co., Box 68 North End Station, Detroit, Mich.
Dried Beet Pulp
Dried Molasses Beet Pulp
Larro
Larro Chick Grains
Larro Chick Starter
Larro Egg Mash
Larro Growing Grains
Larro Growing Mash
Larro Scratch Grains

Francis H. Leggett & Co., Stamford, Conn.
Nabob Scratch Feed
Premier Growing Feed
Premier Mash Feed (egg)
Premier Scratch Feed

C. W. Lines Co., New Britain, Conn.
Homestead Dry Mash
Homestead Scratch Feed
Millpride Dairy Ration
Millpride Milk Mash for Laying Hens
Millpride Fancy Scratch Feed

Litchfield County Coöperative Ass'n, Torrington, Conn.
Common Sense Dairy Ration
Common Sense Growing Mash
Common Sense Laying Mash

Long Hill Feed Store, Long Hill, Conn.
Square Deal Dairy Ration
Square Deal Mash

Louisville Milling Co., Inc., Louisville, Ky.
Sonny South Hominy Feed

L. B. Lovitt & Co., Memphis, Tenn.
"Lovit Brand" 36% Cottonseed Meal
"Lovit Brand" 41% Cottonseed Meal
"Lovit Brand" 43% Cottonseed Meal

E. Manchester & Sons, Winsted, Conn.
Buttermilk Growing Mash
Flour Middlings
Red Star Dairy Feed
Red Star Mixed Feed
Red Star Scratch Feed
Storrs Egg Mash

The Mann Bros. Co., Buffalo, N. Y.
The Mann Bros. Co. 31% Pure Old Process Linseed Meal

Marianna Sales Co., Memphis, Tenn.
White Mule Brand 36% Cottonseed Meal
White Mule Brand 41% Cottonseed Meal
White Mule Brand 43% Cottonseed Meal

Maritime Milling Co., Inc., Buffalo, N. Y.
Bull Brand Chick Feed
Bull Brand Chick Starter (with Dried Buttermilk)
Bull Brand Dairy Ration
Bull Brand Developing Feed
Bull Brand Growing Mash (with Dried Buttermilk)
Bull Brand Heavy Mixed Feed
Bull Brand Laying Mash (with Dried Buttermilk)
Bull Brand Scratch Feed
Bull Brand Stock Feed
Hi-Test Dairy Feed
Red Dog Wheat Flour
Red-E-Lay Laying Mash
Red E Mixt Scratch Feed

A. G. Markham & Co., Springfield, Mass.
Cooked Meat and Bone Scrap 45%
Cooked Meat and Bone Scrap 50%

Geo. E. Marsh Co., Lynn, Mass.
Marsh's Pure Ground Scrap for Poultry

C. J. Martenis Grain Co., L-3 Produce Exchange, New York, N. Y.
Alco Dried Distiller Grains

Meader Milling Co., Inc., Hoboken, N. J.
Green Velvet Feed
Monogram Feed

Meech & Stoddard, Inc., Middletown, Conn.
Red Wing Dairy Ration
Red Wing Mixed Feed
Red Wing Molasses Horse Feed
Red Wing Scratch Feed
Red Wing Special Buttermilk Chick Starter
Red Wing Special Buttermilk Growing Feed
Red Wing Special Buttermilk Laying Mash
Red Wing Special Chick Feed

Red Wing Special Dairy Ration
Red Wing Special Intermediate Chick Feed
Red Wing Stock Feed

Memphis Cottonseed Products Co., Memphis, Tenn.
Durham Forty-One Cottonseed Meal
Durham Forty-Three Cottonseed Meal
Durham Thirty-Six Cottonseed Meal

Miner-Hillard Milling Co., Wilkes-Barre, Pa.
No. 1 Scratch Feed
Rye Middlings
"1795" Steam Cooked Corn and Oats
Steam Cooked Hominy Feed

Geo. Q. Moon & Co., Inc., Binghamton, N. Y.
Moon's Fresh Ground Mixed Feed
Moon's Laying Mash with Dried Buttermilk
Moon's 24% Dairy Ration
Old Times Horse Feed

Moran-Patton Co., New Haven, Conn.
C-B Mash

Fred C. Morse, Guilford, Conn.
Old Mill Buttermilk Laying Mash
Old Mill Dairy Ration
Old Mill Mash Feed
Old Mill Provender
Old Mill Scratch Feed

Mt. Vernon Milling Co., Mt. Vernon, Ind.
Poco Hominy Feed

National Milling Co., Toledo, Ohio.
Osota Feed

R. N. Neal & Co., Memphis, Tenn.
"Triangle" Brand 36% Cottonseed Meal
"Triangle" Brand 41% Cottonseed Meal

Nebraska Consolidated Mills Co., Omaha, Nebr.
Pure Wheat Bran

New England By-Products Co., 20 West St., Lawrence, Mass.
Blue Seal Meat Scraps
White Seal Meat Scraps

Newman Bros. Grain Co., Rochester, N. Y.
Corn Feed Meal
Lay She Will Egg Mash with Buttermilk
Mystic Dairy Ration
Mystic Growing Mash with Buttermilk
Mystic Laying Mash
Mystic Milk Maker
Mystic Stock Feed
Newman's Best Dairy Feed

Newsome Feed & Grain Co., Pittsburgh, Pa.
Palmo Midds

Niagara Falls Milling Co., Niagara Falls, N. Y.
Niagara Choice Wheat Bran
Niagara Choice Wheat Middlings

The Northwestern Consolidated Milling Co., Minneapolis, Minn.
Planet Feed
Pure Wheat Bran
Wheat Flour Middlings
Wheat Mixed Feed
Wheat Standard Middlings
XXX Comet

Norton Tallow Co., Somerville, Mass.
Norton's High Grade Meat and Bone for Poultry

Nowak Milling Corp., Hammond, Ind.
Domino Baby Chick Starter with Buttermilk
Domino Butterine Dairy Feed
Domino Chick Feed
Domino Crate Fattener with Buttermilk
Domino Developing Feed
Domino Growing Mash with Buttermilk
Domino Hog Feed
Domino Horse Feed with Alfalfa
Domino Laying Mash with Buttermilk
Domino Pep O Lene Horse Feed
Domino Pigeon Feed
Domino Scratch Feed
Domino 32% Protein Mixing Dairy Feed
Domino 24½% Dry Dairy Feed
Domino Union Dairy Feed
Domino Vim O Lene Horse Feed
Export Scratch Feed
Fidelity Dairy Feed
Fidelity Horse Feed
Fidelity Scratch Feed
Fidelity Stock Feed
Hammond Dairy Feed
Marathon Chick Feed
Marathon Dairy Feed
Marathon Horse Feed
Marathon Laying Mash with Buttermilk
Marathon Scratch Feed

Ogilvie Flour Mills Co., Ltd., Montreal, Canada.
Ogilvie's Pure Wheat Bran
Ogilvie's Pure Wheat Shorts

Ontario Milling Co., Inc., Oswego, N. Y.
Uncle John's 24% Cream Pot Ration

S. V. Osborn Estate, Branford, Conn.
Osborn Mash
Osborn Provender
Osborn Scratch

Park & Pollard Co., Inc., Buffalo, N. Y.
Arlington Horse Feed
Baby Buster Chick Feed

Belmont Horse Feed
Bet-R-Milk Ration
Bidwell Dry-Mash
Bidwell Scratch Feed
Bison Stock Feed Sweetened
Bonnie Booster
Chelsea Horse Feed
Corn Feed Meal
Corn and Oats ½ and ½
Go Tu It Hog Ration
Growing Feed
Herdhelth Ration
Intermediate Chick Feed
Lay or Bust Dry Mash
Leghorn Special Dry-Mash
Milk-Maid 24% Dairy Ration
Overall 24% Dairy Ration
Over the Top Scratch Feed
Papco Mixed Feed
Pigeon Feed
Pretty Special Mixed Feed
Red Ribbon Chick Feed
Red Ribbon Scratch Feed
Stevens "44" Dairy Ration
Stevens "44" Sweetened Dairy Ration
Stevens Milkade Calf Meal
The Park & Pollard Co. Dairy Growing Ration
The Park & Pollard Co. 16% Dairy Ration
The Park & Pollard Co. 20% Dairy Ration
The Park & Pollard Stock Feed
Wheat Flour Middlings

The Patent Cereals Co., Geneva, N. Y.
Hominy Feed

Penick & Ford, Ltd., Inc., Cedar Rapids, Iowa.
Douglas Corn Gluten Feed
Douglas Corn Gluten Meal

The Peterson-Hendee Co., Derby, Conn.
P-H Mash
P-H Scratch Feed

Philadelphia Seed Co., Inc., 103-105 Arch St., Philadelphia, Pa.
Purgrain Breeding Feed
Purgrain Pigeon Feed No. 4

Pillsbury Flour Mills Co., Minneapolis, Minn.
Palisade Chick Feed, No Grit
Pillsbury's Chick Grains, No Grit
Pillsbury's Dairy Ration
Pillsbury's Durum Wheat Bran and Screenings
Pillsbury's Egg Mash
Pillsbury's Fancy Mixed Feed and Screenings
Pillsbury's Growing Grains
Pillsbury's Growing Mash with Buttermilk
Pillsbury's Hard Wheat A Middlings and Screenings
Pillsbury's Hard Wheat Bran and Screenings
Pillsbury's Hard Wheat Standard B Middlings and Screenings

Pillsbury's Rye Middlings and Screenings
Palisade Scratch Feed, No Grit
Pillsbury's Scratch Grains
Pillsbury's Starting Feed with Buttermilk
Pillsbury's XX Daisy
Pillsbury's Wheat Bran and Screenings
Pillsbury's Wheat Gray Shorts

Pittsburgh Plate Glass Co., Newark, N. J.
Red Wing Linseed Meal

Frank S. Platt Co., Inc., New Haven, Conn.
Platco Laying Mash
Platco Perfection Grain Mixture
Platt's Pigeon Mixture

Postum Cereal Co., Inc., Battle Creek, Mich.
Burt's Cereal Feed
Burt's Dairy Feed
Burt's Hominy Feed
Burt's Stock Feed

W. N. Potter & Sons, Inc., Greenfield, Mass.
A. D. P. 24% Dairy Ration
Puritan Dry Mash
Puritan Growing Feed

Pratt Food Co., Hammond, Ind.
Pratt's Baby Chick Food with Buttermilk
Pratt's Circle A Chick Scratch Feed
Pratt's Circle A Large Scratch Feed
Pratt's Supreme Dairy Ration
Pratt's Supreme Growing Mash with Buttermilk
Pratt's Supreme Pigeon Feed with Flint Corn
Pratt's Supreme Stock Feed
Pratt's Victory Chick Scratch Feed
Pratt's Victory Intermediate Scratch Feed
Pratt's Victory Laying Mash with Buttermilk
Pratt's Victory Large Scratch Feed

(Buffalo Mills)
Armour's 24% Dairy Feed
Cak Cak Laying Mash with Buttermilk, Oat Meal, Fish, Meat, etc.
Iroquois Chop Feed
Iroquois Laying Mash
Iroquois Poultry Mash
Iroquois Scratching Grains
Pratt's White Hominy Feed

H. C. Puffer Co., Springfield, Mass.
Egg-Em-On Growing Feed
Egg-Em-On Laying Mash
Egg-Em-On Scratch Grains
Producer Dairy Feed

The Quaker Oats Co., Chicago, Ill.
Bell Cow Bran
Bell Cow Shorts
Big Egg Scratch Grains, No Grit
Buckeye Feed

Fine Ground Oat Feed
Hominy Feed (Aunt Jemima Mills Branch, St. Joseph, Mo.)
Quaker Ful-O-Pep Chick Starter
Quaker Ful-O-Pep Coarse Chick Feed
Quaker Ful-O-Pep Egg Mash
Quaker Ful-O-Pep Fine Chick Feed
Quaker Ful-O-Pep Growing Mash
Quaker Ful-O-Pep Scratch
Quaker Green Cross Horse Feed
Quaker Pig-N-Hog Meal
Quaker Schumacher Feed
Quaker 16% Protein Dairy Ration
Quaker 20% Protein Big "Q" Dairy Ration
Quaker 24% Protein Boss Dairy Ration
Richford White Diamond Stock Feed
Schumacher Calf Meal
Schumacher Little Chick Feed, No Grit
Schumacher Scratch Grains, No Grit
Sterling Stock Feed with Molasses
Vim Feed
White Hominy Feed
White Star Stock Feed, Fine
Yellow Hominy Feed
Quaker Sugared Schumacher Feed

Ralston Purina Co., St. Louis, Mo.

Fine Ground Green Poultry Alfalfa Meal
Corn Feed Meal
Protena Dairy Feed
Purina Baby Chick Chow Feed
Purina Bulky Las Feed
Purina Calf Chow Feed
Purina Chicken Chowder Feed containing Charcoal not over 1%
Purina Chicken Fatena Feed
Purina Chicken Fat Chow Feed
Purina Chick Growena Feed
Purina Chick Startena Feed
Purina Cow Chow Feed
Purina Hen Chow Feed
Purina Intermediate Hen Chow Feed
Purina Omolene Feed
Purina Pig Chow Feed containing Charcoal not over 1%
Purina Pigeon Chow Feed
Purina Pigeon Chow Feed containing Corn
Purina Steer Fatena Feed containing Charcoal not over 1%
Winner Scratch Feed

E. Rauh & Sons Fertilizer Co., Indianapolis, Ind.

Meato

John Reardon & Sons Co., Cambridge, Mass.

Reardon's 45% Meat and Bone Scrap
Reardon's 55% Meat Scraps

Red Wing Milling Co., Red Wing, Minn.

Red Wing Special Standard Wheat Middlings
Red Wing Special Wheat Bran

Riverdale Products Co., Chicago, Ill.
Chapman's Special Odorless Steamed Bone Meal

Robin Hood Mills, Calgary, Canada.
Superior Pure Wheat Bran
Superior Pure Wheat Shorts

Rockville Grain & Coal Co., Rockville, Conn.
Diamond Dairy Feed
Diamond Scratch Feed

The Rogers & Hubbard Co., Portland, Conn.
Edible Bone Flour

Russell-Miller Milling Co., Minneapolis, Minn.
Alta Hard Wheat Middlings
Hard Wheat Occident Bran
Hard Wheat Occident Mixed Feed

Russia Cement Co., Gloucester, Mass.
Chic-Chuk, "The Ideal Concentrated Poultry Food"

B. F. Schwartz & Co., 2 Broadway, N. Y.
Wheat Bran
Wheat Standard Middlings

P. Schwartz Co., New London, Conn.
Homespun Dairy
Homespun Mash
Homespun Scratch
Homespun Stock

Seymour Grain & Coal Co., Seymour, Conn.
See-More-Egg Buttermilk Mash
See-More-Milk Dairy Ration
See-More-Egg Scratch Feed

The Sheets Elevator Co., Cleveland, Ohio.
Diamond Horse Feed
S. B. Alfalfa Horse Feed
S. B. Horse and Mule Feed

Sheffield Elevator Co., Minneapolis, Minn.
Sherwin-Williams Old Process Meal

Shelton Feed Co., Inc., Shelton, Conn.
Nelson's Laying Mash
Nelson's Mixed Feed

Winchell Smith, Inc., Farmington, Conn.
Mill Streams "Boomerang" Dairy Feed
Mill Streams "Fortune Hunter" Scratch Grains
Mill Streams "Lightnin" Laying Mash
Mill Streams "Twenty Percent" Dairy Feed

The Southwestern Milling Co., Inc., Kansas City, Mo.
Red Turkey Pure Wheat Bran

Spratt's Patent (American), Ltd., Newark, N. J.
Spratt's Chicgrain
Spratt's Mash Food with Buttermilk

Springfield Rendering Co., Springfield, Mass.
Springfield Bone Meal
Springfield Ground Meat Scraps

A. E. Staley Manufacturing Co., Decatur, Ill.
Staley's Corn Gluten Feed

John T. Stanley Co., Inc., 642 West 30th St., New York, N. Y.
Stanley's 45% to 50% Protein Meat and Bone Scrap

State Mill & Elevator Co., Grand Forks, N. Dak.
Dakota Maid Standard Wheat Middlings

St. Albans Grain Co., St. Albans, Vt.
Brewers' Dried Grains
Charlestock
King Baby Chick Food containing Buttermilk
King Chick Feed
King Dairy Feed with Beet Pulp
King Growing Feed containing Dried Buttermilk and Beef Scraps
King Intermediate Chick Feed
King Mash Feed containing Buttermilk
King Scratch Feed
King Stock Feed
King 22 Protein Milk Ration
Paragon Dairy Feed for Dairy Cows
Paragon Gritless Chick Feed
Paragon Hominy Feed
Paragon Scratch Feed
Wirthmore Balanced Ration for Dairy Cows
Wirthmore Buttermilk Baby Chick Food
Wirthmore Buttermilk Mash Feed with Fish and Meat Scraps
Wirthmore Certified Scratch Feed
Wirthmore Flour Middlings
Wirthmore Gritless Chick Feed
Wirthmore Growing Feed with Dried Buttermilk and Beef Scraps
Wirthmore Intermediate Chick Feed
Wirthmore Pig Feed
Wirthmore Scratch Feed
Wirthmore 16% Summer Ration containing Minerals
Wirthmore Stock Feed
Wirthmore 20% Dairy Feed
Wirthmore Wheat Feed

The St. Lawrence Flour Mills Co., Ltd., Montreal, Canada.
Bran

Syracuse Milling Co., Syracuse, Onondaga County, N. Y.
Jordan Horse Feed with Molasses
Jordan Sweet Dairy Feed
Onondaga Dairy Feed
Onondaga Scratch Grains
Symco Scratch Grains
Syragold Chick Feed

Syragold Chick Starter
Syragold Dairy Feed
Syragold Egg Mash
Syragold Feed Meal
Syragold Growing Mash
Syragold Horse Feed with Molasses
Syragold Milk Ration
Syragold Scratch Grains
Syragold Stock Feed

D. L. Talcott, Torrington, Conn.
Talcott's Economy Dairy Ration

Thomaston Supply Co., Inc., Thomaston, Conn.
Thomaston Dairy
Thomaston Egg Mash
Thomaston Scratch Feed

Thompson Milling Co., Lockport, N. Y.
Angelus Wheat Bran with Ground Screenings
Angelus Wheat Middlings with Ground Screenings

Thornton & Chester Milling Co., Buffalo, N. Y.
T & C Wheat Bran
T & C Wheat Mixed Feed
T & C Standard Midds

Tioga-Empire Feed Mills, Inc., Waverly, N. Y.
Blue Brand Tioga Dairy Feed
Chicatine
Colonel's Ration
Derby Corn and Oat Feed
Derby Meal
Derby Scratch Feed
Egatine
E-Gee Stock Feed
OrCo Feed
Red Brand Ti-O-Ga Dairy Feed
Ti-O-Ga Calf Food
Tioga Chick Grains
Ti-O-Ga Growing Grains
Ti-O-Ga Growing Mash
Ti-O-Ga Laying Food
Tioga Poultry Grain
White Brand Tioga Dairy Feed

Traders Feed & Grain Co., Inc., Buffalo, N. Y.
Bonny Brand Hard Wheat Bran and Screenings

The Ubiko Milling Co., Cincinnati, Ohio.
Union Grains Biles Ready Dairy Ration

Union Starch & Refining Co., Columbus, Ind.
Union Corn Gluten Feed

United Flour & Feed Co., Inc., Albany, N. Y.
Chicklet Intermediate Chick Feed
Rex Dairy Feed

Rex Scratch Feed
United Dairy Ration
United Laying Mash (with Buttermilk)
United Laying Mash (Storrs' Formula)
United Scratch Feed
Waldorf Milk Grains

Van Vechten Milling Co., Inc., Rochester, N. Y.

Irving Mills Rye Feed

Victor Flour Mills, Inc., Pittsford & Victor, N. Y.

Victor Spring Wheat Bran
Victor Spring Wheat Middlings

Vitality Mills, 1254 Continental & Commercial Bank Bldg., Chicago, Ill.

Advance Dairy Feed
Advance Egg Mash with Buttermilk
Advance Scratch Feed, No Grit
"77" Scratch Feed, No Grit
"77" Stock Feed
Special Rosebro Horse Feed
Vitality Chick Starter
Vitality Coarse Chick Scratch
Vitality Dairy Feed
Vitality Egg Mash
Vitality Fine Chick Scratch
Vitality Growing Mash
Vitality Pigeon Feed, No Corn, No Grit
Vitality Scratch-NG
Will Pay Dairy Ration

Wadsworth Feed Co., Warren, Ohio.

Wadfeeco Dairy Ration
Wadsworth's Special Dairy Ration

Washburn-Crosby Co., Minneapolis, Minn.

Eventually Gold Medal Chick Feed, No Grit
Eventually Gold Medal Chick Starter (with Dried Buttermilk)
Eventually Gold Medal Developing Feed, No Grit
Eventually Gold Medal Growing Mash (with Dried Buttermilk)
Eventually Gold Medal Hard Wheat Bran
Eventually Gold Medal Hard Wheat Flour Middlings
Eventually Gold Medal Hard Wheat Standard Middlings
Eventually Gold Medal Pure Hard Wheat Adrian Red Dog
Eventually Gold Medal Scratch Feed, No Grit
Eventually Gold Medal Vitimin Dairy Ration (containing Wheat Germ)
Eventually Gold Medal Vitimin Dairy Ration (24% Protein)
Eventually Gold Medal Vitimin Egg Mash (containing Wheat Germ Embryo)
Gold Medal Corn and Oat No. 2
Gold Medal Hominy Feed (Guaranteed Pure)
North Star Scratch Feed, No Grit
Washburn's Gold Medal Fancy Mixed Feed

Worcester Rendering Co., Auburn, Mass.

P. W. Meat Scrap
P. W. Special Meat Scrap

Yantic Grain & Products Co., 3 Cove St., Norwich, Conn.

Abington Dairy Feed
Big (Y) Dairy Ration
Big (Y) Flour Middlings
Big (Y) Growing Feed
Big (Y) Laying Mash
Big (Y) Mixed Feed
Echo Dairy Feed
Perfection Dairy Feed
Uncas Dairy Feed
Uncas Stock Feed

INSPECTION.

(For the year September 1, 1926, to August 31, 1927.)

During the year 898 samples of commercial feeding stuffs and other fodder materials have been analyzed. Of this number 670 were official samples drawn by the Station inspector; 141 were examined for the Storrs Station in connection with field and other experiments; and the remainder were submitted by individuals. Only those samples taken for official inspection purposes and those examined for individuals are discussed in this report.

The Station inspector has visited 145 grain dealers in 99 towns in the State and collected 672 samples of feeds which number includes all the brands which could be found on sale. Results of analyses as soon as available have been reported to manufacturers or jobbers, dealers and others interested. In cases of deficiencies second samples were drawn and analyzed if they could be obtained.

Analyses are given in Table I. Deficiencies greater than 0.75 per cent in protein and fiber and 0.25 per cent in fat are given in bold face type. Analyses of unofficial samples appear in Table II.

About one-sixth of the total number of samples analyzed were deficient in one or more of the nutrients guaranteed. These deficient samples were confined largely to the class of proprietary mixed feeds. With three items of nutrients guaranteed on each sample there were 2,010 guaranties made and 126 deficiencies were found. In other words 83 per cent of the samples met or exceeded guaranties and 94 per cent of the guaranties made were substantially met or exceeded. These percentages are almost identical with similar ones computed for the inspection of 1925.

It is illegal in this State to attach tags by means of wire or other metallic device and the practice has been largely abandoned. Only two instances of such practice were found during the past year.

A careful microscopic examination of all feeds has been made to identify the ingredients claimed to be present. In general, the ingredients found were substantially as declared and no acceptable evidence of the substitution of inferior materials was obtained.

The following tabulated statement summarizes the results of the inspection.

SUMMARY OF INSPECTION.

Feed	Samples examined	Samples deficient	Deficiencies in Protein	Deficiencies in Fat	Deficiencies in Fiber	Total deficiencies
Cottonseed Meal	23	9	5	2	5	12
Linseed Meal	9	0	0	0	0	0
Wheat Bran	27	0	0	0	0	0
Wheat Middlings	36	2	0	0	2	2
Wheat Red Dog	3	1	0	0	1	1
Wheat Feed (Mixed Feed)	21	0	0	0	0	0
Corn Gluten Feed	9	0	0	0	0	0
Hominy Feed	17	4	1	0	4	5
Rye Products	3	0	0	0	0	0
Brewers' and Distillers' Grains	4	1	1	0	0	1
Dried Beet Pulp	2	0	0	0	0	0
Horse Feeds, etc.	48	6	0	1	5	6
Dairy Feeds	126	29	11	8	12	31
Stock Feeds	39	10	2	8	2	12
Calf Feeds, etc.	9	1	0	0	1	1
Poultry Feeds	259	39	6	6	31	43
Beef Scrap, etc.	35	12	9	0	3	12
Totals	670	114	35	25	66	126

Feeds should be free from viable weed seeds but in commercial practice it is doubtful if the destruction of such seeds is ever complete. In a few instances the presence of whole weed seeds was conspicuous. Samples **6311**, International Ready Ration Dairy Feed, **6312**, International Special Dairy Feed, and **6313**, International Diamond Dairy Feed, made by the International Sugar Feed Co., Minneapolis, contained whole seeds estimated at from 4,000 to 12,000 per pound of feed, germination tests showing that from 3 per cent to 7.5 per cent were likely to grow. The seeds were mainly pigweed, barnyard grass, shepherd's purse and smartweed. Sample **6392**, Hammond Dairy Feed, also contained many whole seeds but none germinated. If fed to sheep and poultry these weed seeds would probably be destroyed; but if fed to cattle many seeds would be transferred to the fields in the stable manure.

Tables of Analyses.

Analyses of official samples taken for inspection purposes are given in Table I, pages 518 to 571 inclusive. Analyses of samples drawn and submitted by individuals are given in Table II, pages 572 to 575 inclusive. For these last named samples the Station is responsible for the analyses only.

In certain cases the brand names as they appear in Table I do not correspond in all respects with names as they appear in the registration list. This is because limited space may have required some abbreviation of titles in the analytical tables; and again, brand names may have been revised by manufacturers after our samples were taken.

[illegible] ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1920.

...er and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
... PRODUCTS.										
...seed Meal.										
... Allen Co., At- ...	*Granby:* E. H. Rollins	6.80	5.72	41.13	41.00	10.75	10.00	29.51	6.09	6.00
... Allen Co., At- ...	*New Hartford:* Geo. W. Case, Inc.	5.85	5.69	42.56	43.00	10.58	10.00	29.04	6.28	6.00
...ift-Wilkinson Co., ...	*Torrington:* D. L. Talcott	9.03	6.34	40.50	41.00	9.90	10.00	27.78	6.45	6.00
...hcraft - Wilkinson Ga. ...	*Danielson:* Young Bros. Co. ...	6.05	5.76	42.63	43.00	10.29	10.00	28.62	6.65	6.00
...shcraft-Wilkinson Ga. ...	*North Haven:* W. L. Thorpe ...	7.40	5.07	34.69	36.00	14.15	14.00	32.94	5.75	5.50
...shcraft-Wilkinson Ga. ...	*New Haven:* R. G. Davis & Sons	6.75	6.10	38.25	36.00	11.21	14.00	30.09	7.60	5.50
...Davis, Little Rock, ...	*Thompsonville:* Geo. S. Phelps & Co.	6.20	5.05	35.88	36.00	15.20	14.00	32.32	5.35	6.00
...Davis, Little Rock, ...	*Thompsonville:* Geo. S. Phelps & Co.	7.35	5.01	35.13	36.00	14.79	14.00	32.19	5.53	6.00
...P. Davis, Little ...	*Manchester:* O. E. Bailey	7.55	6.50	40.88	41.00	10.08	10.00	27.96	7.03	6.00
...eys-Godwin Co., ...m. ...	*Rockville:* Rockville Grain & Coal Co.	6.48	5.81	43.00	43.00	9.50	10.00	28.88	6.33	5.00
...reys-Godwin Co., ...m. ...	*Guilford:* Fred C. Morse	6.40	5.90	36.00	36.00	13.38	15.00	31.97	6.35	5.00

543	*Dixie.* Humphreys-Godwin Co., Memphis, Tenn.	*Watertown:* Watertown Co-op. Assoc.	8.20	5.62	41.69	41.00	9.53	10.00	28.34	6.62	5.00
404	*International Rainbow.* International Agricultural Corp., Columbus, Ga.	*North Haven:* W. L. Thorpe	7.60	6.39	38.50	36.00	10.45	14.00	30.33	6.73	5.00
885	*International Rainbow* 43%. International Agricultural Corp., Columbus, Ga.	*Bloomfield:* Bloomfield Farmers' Exchange	6.23	6.56	41.31	43.00	8.85	14.00	29.97	7.08	6.00
237	*International Rainbow* 43%. International Agricultural Corp., Columbus, Ga.	*Bloomfield:* Bloomfield Farmers' Exchange	7.73	6.65	41.25	43.00	8.20	14.00	28.13	8.04	6.00
931	*Zenith* 36%. International Agricultural Corp., Columbus, Ga.	*Wallingford:* A. E. Hall	7.70	5.78	36.19	36.00	12.93	14.00	31.25	6.15	6.00
367	*Lovit* 36%. L. B. Lovitt & Co., Memphis, Tenn.	*Middletown:* Meech & Stoddard, Inc.	8.40	5.38	37.81	36.00	11.50	15.00	29.81	7.10	5.00
692	*Lovit* 43%. L. B. Lovitt & Co., Memphis, Tenn.	*Danielson:* Young Bros.	6.18	6.80	43.88	43.00	7.85	10.00	27.34	7.95	6.00
999	*White Mule* 36%. Marianna Sales Co., Memphis, Tenn.	*New Hartford:* Geo. W. Case, Inc.	7.38	5.20	34.88	36.00	14.75	14.00	31.49	6.30	5.00
994	*White Mule* 41%. Marianna Sales Co., Memphis, Tenn.	*East Haven:* A. W. Forbes	7.23	6.37	40.75	41.00	11.03	10.00	28.32	6.30	6.00
997	*White Mule* 43%. Marianna Sales Co., Memphis, Tenn.	*Woodbury:* C. L. Adams Co.	8.23	6.31	44.06	43.00	11.03	10.00	21.52	8.85	6.00
803	*Durham* 36%. Memphis Cottonseed Products Co., Memphis, Tenn.	*New Haven:* R. G. Davis & Sons	6.93	5.44	35.56	36.00	14.70	10.00	31.14	6.23	5.00
804	*Durham* 43%. Memphis Cottonseed Products Co., Memphis, Tenn.	*Plantsville:* C. A. Cowles	13.64	5.60	40.19	43.00	10.90	10.00	22.77	6.90	6.00
	Linseed Meal, Old Process.										
1390	*Amco.* American Milling Co., Peoria, Ill.	*Rockville:* Rockville Grain & Coal Co.	8.95	5.54	31.56	30.00	9.65	10.00	36.92	7.38	5.00
1187	*Pure.* Archer-Daniels Midland Co., Minneapolis, Minn.	*Plantsville:* C. A. Cowles	9.55	6.06	32.25	32.00	8.00	9.00	37.99	6.15	5.00
1261	*Pure.* Archer-Daniels Midland Co., Minneapolis, Minn.	*Hazardville:* Amos D. Bridges Sons	9.33	5.67	34.38	34.00	8.03	9.00	37.69	4.90	5.00

Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
		Pounds per Hundred								
OIL SEED PRODUCTS—*Concluded.* *Linseed Meal, Old Process—Concluded.*										
"Maple Leaf." Canada Linseed Oil Mills, Montreal, Canada..	*Norwich:* Yantic Grain & Products Co.	10.50	4.56	36.38	35.00	6.56	7.00	36.27	5.73	5.00
Kellogg's. Spencer Kellogg & Son, Buffalo, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	10.18	5.05	36.25	34.00	7.23	10.00	34.36	6.93	5.00
Kellogg & Miller, Amsterdam, N. Y.	*New Milford:* Geo. T. Soule ...	8.45	5.49	32.13	31.00	7.18	9.00	40.27	6.48	5.00
Pure. Mann Bros. Co., Buffalo, N. Y.	*Manchester:* Manchester Grain Co.	10.25	5.50	30.50	31.00	8.40	10.00	37.65	7.70	6.00
Red Wing. Pittsburgh Plate Glass Co., Newark, N. J.	*Thomaston:* Thomaston Supply Co.	9.60	5.61	33.63	34.00	7.55	9.00	36.46	7.15	6.00
Sherwin-Williams. Sheffield Elevator Co., Minneapolis, Minn.	*Rockville:* Rockville Milling Co.	7.15	4.94	36.81	35.00	7.65	7.50	35.25	8.20	5.50
WHEAT PRODUCTS. *Wheat Bran.*										
Wingold. Bay State Milling Co., Winona, Minn.	*Danbury:* F. C. Benjamin	9.90	6.35	16.56	15.20	8.90	12.40	53.19	5.10	5.30
Dandy. Copeland Flour Mills, Midland, Canada	*Unionville:* F. D. Lawton & Son	9.88	5.64	15.88	15.00	10.04	11.50	52.83	5.73	3.50
Dominion Flour Mills, Montreal, Canada	*Guilford:* Fred C. Morse	8.18	5.50	17.10	15.00	10.13	11.50	53.07	5.03	3.50

Duluth Imperial. Duluth Superior Mills, Duluth, Minn.	*Stepney:* M. Nusbaum	10.73	5.26	16.06	14.00	8.30	13.00	54.05	5.60	3.75
The Fairchild Milling Co., Cleveland, Ohio	*Highwood:* T. C. Hadden & Co.	12.15	5.23	16.19	14.00	8.36	12.00	53.85	4.22	3.50
The Fairchild Milling Co., Cleveland, Ohio	*Highwood:* T. C. Hadden & Co.	11.33	5.24	16.31	14.00	8.35	12.00	53.52	5.25	3.50
Wm. Hamilton & Son, Honeoye Falls, N. Y.	*Westerly:* C. W. Campbell Co.	10.68	5.49	13.88	13.25	8.80	11.60	57.15	4.00	2.90
Choice. Hecker-Jones-Jewell Milling Co., New York City	*Higganum:* F. A. Petrofsky	9.55	6.35	16.94	14.00	9.35	14.00	52.46	5.35	3.50
Blackhawk. International Milling Co., Minneapolis, Minn.	*Plantsville:* Mehmel & Sarvi	11.04	6.05	14.88	15.00	11.54	12.00	52.10	4.39	3.20
Big Flake. Kansas Flour Mills Corp., Kansas City, Mo.	*Southbury:* H. R. Stone	10.02	7.30	15.94	15.00	9.33	11.00	53.31	4.10	3.50
The Larrabee Flour Mills Corp., Wellington, Kans.	*Hazardville:* Amos D. Bridges Sons	7.78	6.27	16.94	15.00	8.98	10.00	56.03	4.00	3.50
Maple Leaf Milling Co., Toronto, Canada	*Plainville:* M. Kosenko	10.63	5.59	15.06	15.00	10.13	11.50	52.91	5.68	3.50
Pure. Nebraska Consolidated Milling Co., Omaha, Neb.	*East Winsted:* Leonard Grain Co.	10.15	5.69	16.69	15.50	8.00	11.00	54.02	4.55	3.50
Niagara Choice. Niagara Falls Milling Co., Niagara Falls, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	10.03	6.25	16.13	15.00	9.13	11.00	53.26	5.20	3.50
Pure. Northwestern Consolidated Milling Co., Minneapolis, Minn.	*North Haven:* W. L. Thorpe	11.68	6.26	16.31	13.00	9.28	12.00	51.64	4.83	4.00
Ogilvie Pure. Ogilvie Flour Mills, Montreal, Canada	*Rockville:* Rockville Grain & Coal Co.	10.35	5.17	15.25	15.00	9.54	11.50	54.07	5.62	3.50
Pillsbury Flour Mills Co., Minneapolis, Minn.	*Wallingford:* Laden Bros.	10.98	5.81	16.63	14.00	8.48	12.00	53.30	4.80	4.00
Bell Cow. Quaker Oats Co., Chicago, Ill.	*Waterbury:* H. S. Coe & Co., Inc.	10.43	5.09	16.19	15.00	9.18	10.00	53.93	5.18	3.50
Red Wing Special. Red Wing Milling Co., Red Wing, Minn.	*Plantsville:* Mehmel & Sarvi	7.75	6.03	15.75	13.50	10.68	15.60	54.31	5.48	4.10
Occident. Russell Miller Milling Co., Minneapolis, Minn.	*Windsor:* W. C. Everett	11.10	6.41	18.00	14.00	8.65	11.50	50.84	5.00	4.00
B. F. Schwartz & Co., New York City	*Thompsonville:* Geo. S. Phelps & Co.	9.83	6.07	14.50	13.00	10.65	13.00	54.67	4.28	4.00

[1] Wire tags illegal.

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	WHEAT PRODUCTS—*Continued* *Wheat Bran—Concluded.*										
5639	*Red Turkey.* Southwestern Milling Co., Kansas City, Mo.	*Lakeville:* E. W. Spurr Co.	9.10	6.14	16.50	14.50	8.75	11.00	54.98	4.53	3.50
5542	St. Lawrence Flour Mills, Montreal, Canada	*Woodbury:* C. L. Adams Co. ..	8.95	5.39	15.81	15.00	9.99	11.50	54.31	5.55	3.50
5888	*Angelus.* Thompson Milling Co., Lockport, N. Y.	*New Britain:* Stanley Svea Coal Co.	10.65	5.97	16.13	15.50	9.38	11.50	52.62	5.25	4.00
5412	*Victor Spring.* Victor Flour Mills, Victor, N. Y.	*East Hartford:* Meech Grain Co.	10.70	5.17	17.63	15.00	8.83	11.00	51.89	5.78	4.00
5190	*Gold Medal.* Washburn-Crosby Co., Minneapolis, Minn.	*Southington:* Southington Lumber Co.	9.58	5.71	14.31	14.00	9.58	12.00	55.34	5.48	4.00
5167	*Pioneer.* Western Canada Flour Mills, Goderich, Canada	*West Cheshire:* Cheshire Grain & Coal Co.	11.65	5.10	16.50	15.00	9.70	11.50	51.37	5.68	3.50
	Wheat Middlings, etc.										
5638	*Wingold Fancy White Flour.* Bay State Milling Co., Winona, Minn.	*Torrington:* D. L. Talcott	9.48	2.42	17.88	18.70	2.06	4.60	64.03	4.13	5.00
5015	*Wingold Fancy White Flour.* Bay State Milling Co., Winona, Minn.	*Torrington:* D. L. Talcott	10.30	2.65	17.88	17.50	2.95	3.50	61.87	4.35	3.50
5642	*Wingold Standard.* Bay State Milling Co., Winona, Minn. ..	*Torrington:* D. L. Talcott	8.80	4.58	17.94	16.60	8.05	8.00	54.78	5.85	4.00

3687	*Pioneer Shorts.* Chas. M. Cox, Boston, Mass.	*Torrington:* D. L. Talcott	9.55	4.14	18.13	16.00	7.59	11.00	54.06	6.53	4.50
5509	*Pioneer Shorts.* Chas. M. Cox, Boston, Mass.	*Thomaston:* Peter Cunningham	10.60	3.96	17.75	16.00	7.12	9.00	54.57	6.00	4.50
6591	*Flour.* John W. Eshelman & Sons, Lancaster, Pa.	*Thomaston:* Thomaston Supply Co.	10.35	3.16	17.25	16.00	4.58	6.00	60.21	4.45	4.00
5418	*E. A. Co. Standard.* Everett, Aughenbaugh & Co., Minneapolis, Minn.	*Unionville:* F. D. Lawton & Son	10.50	5.08	18.19	15.00	7.65	9.50	52.94	5.64	3.00
5995	*Shorts.* Dominion Flour Mills, Montreal, Canada	*Guilford:* Fred C. Morse	8.48	4.20	18.50	16.00	7.65	8.00	55.27	5.90	5.00
5151	*Special.* Fairchild Milling Co., Cleveland, Ohio	*Highwood:* T. C. Hadden & Co.	10.48	3.50	16.13	13.00	5.00	8.00	60.94	3.95	3.50
5340	*Standard.* Fairchild Milling Co., Cleveland, Ohio	*Guilford:* F. H. Rolf	11.10	5.52	18.38	15.00	6.83	9.00	53.27	4.90	4.00
5740	*Dairy Maid.* Federal Mill & Elevator Co., Lockport, N. Y.	*Putnam:* Bosworth Bros.	9.88	2.86	15.31	15.50	4.65	6.00	62.67	4.63	4.50
5469	Wm. Hamilton & Son, Honeoye Falls, N. Y.	*Derby:* Peterson-Hendee Co.	10.25	3.16	15.56	14.90	3.95	5.40	62.45	4.63	4.90
5231	Hecker-Jones-Jewell Milling Co., New York City	*Meriden:* Meriden Grain & Coal Co.	9.38	4.58	16.63	15.00	7.10	9.50	56.98	5.33	5.00
6316	Hecker-Jones-Jewell Milling Co., New York City	*Hazardville:* Amos D. Bridges Sons	10.20	4.66	18.06	15.00	7.91	9.50	52.74	6.43	4.75
5185	*Black Hawk.* International Milling Co., Minneapolis, Minn.	*Plantsville:* Mehmel & Sarvi	10.38	4.75	17.44	16.00	7.50	8.50	54.33	5.60	4.50
5576	*Flour.* E. Manchester & Sons, Winsted	Sampled at factory	9.08	4.15	16.19	15.00	4.42	6.00	62.36	3.80	4.00
5173	*Rex.* Maple Leaf Milling Co., Toronto, Canada	*Plainville:* M. Kosenko	10.68	4.08	17.44	17.50	6.58	7.50	55.64	5.58	5.50
6233	*Palmo Midds.* Newsome Feed & Grain Co., Pittsburgh, Pa.	*Middletown:* Meech & Stoddard, Inc.	7.65	5.16	16.06	16.00	6.43	9.00	55.37	9.33	7.00
5246	*Niagara Choice.* Niagara Falls Milling Co., Niagara Falls, N. Y.	*Meriden:* H. Grulich	10.25	4.59	16.94	15.50	6.83	9.50	55.89	5.50	4.00
5214	*Flour.* Northwestern Consolidated Milling Co., Minneapolis, Minn.	*North Haven:* W. L. Thorpe	11.05	3.93	18.75	15.00	5.60	6.00	55.72	4.95	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	WHEAT PRODUCTS—*Continued.*										
	Wheat Middlings, etc.—Concl.										
5211	*Standard.* Northwestern Consolidated Milling Co., Minneapolis, Minn.	*North Haven:* W. L. Thorpe	10.00	4.55	17.56	15.00	8.73	9.50	53.48	5.68	4.00
5485	*Ogilvie's Shorts.* Ogilvie Flour Mills Co., Montreal, Canada	*Seymour:* Seymour Grain & Coal Co.	10.09	4.14	17.44	16.00	6.98	8.00	55.57	5.78	5.00
5206	*Flour.* Park & Pollard Co., Buffalo, N. Y.	*Plainville:* F. B. Newton	11.70	3.88	16.44	16.00	5.28	6.00	59.02	3.68	4.00
5672	*Flour.* Park & Pollard Co., Buffalo, N. Y.	*West Stafford:* C. P. Bradway	10.50	3.12	15.88	16.00	5.23	6.00	60.84	4.43	4.00
5171	*Pillsbury's A with Screenings.* Pillsbury Flour Mills, Minneapolis, Minn.	*West Cheshire:* Cheshire Grain & Coal Co.	10.85	2.99	18.75	16.00	3.90	6.00	58.11	5.40	4.00
5165	*Pillsbury's Standard B with Screenings.* Pillsbury Flour Mills, Minneapolis, Minn.	*Hamden:* Ira W. Beers	10.83	4.13	17.63	15.00	6.75	9.50	55.28	5.38	4.00
5161	*Bell Cow Shorts with Screenings.* Quaker Oats Co., Chicago, Ill.	*Plainville:* M. Kosenko	11.85	3.80	16.56	15.00	6.28	8.00	55.86	5.65	4.00
6196	*Red Wing Special.* Red Wing Milling Co., Red Wing, Minn.	*Plantsville:* Mehmel & Sarvi	6.95	4.94	18.31	15.00	8.30	9.50	55.62	5.88	5.10
6012	*Standard.* B. F. Schwartz & Co., New York City	*Middletown:* Meech & Stoddard, Inc.	11.13	4.20	16.69	14.00	7.63	9.50	55.65	4.70	4.00

	State Mill & Elevator Co., Grand Forks, No. Dak.	*Jewett City:* Red Wing Feed Store	9.83	3.99	16.94	16.10	6.15	8.10	57.21	5.88	5.70
5436	*Wirthmore Flour.* St. Albans Grain Co., St. Albans, Vt.	*Granby:* E. H. Rollins	10.92	4.33	14.44	14.00	5.71	6.00	59.38	5.22	4.00
5889	*Angelus with Screenings.* Thompson Milling Co., Lockport, N. Y.	*New Britain:* Stanley Svea Coal Co.	10.78	4.54	17.69	15.50	7.33	7.00	54.51	5.15	4.50
5332	*Gold Medal Flour.* Washburn-Crosby Co., Minneapolis, Minn.	*Branford:* S. V. Osborn Est.	10.23	3.62	16.88	16.00	4.28	6.00	60.64	4.35	4.00
5306	*Gold Medal Standard.* Washburn-Crosby Co., Minneapolis, Minn.	*East Haven:* A. W. Forbes	11.38	4.67	17.50	15.00	6.75	9.50	54.67	5.03	4.00
5739	*Big Y Flour.* Yantic Grain & Products Co., Norwich	*Willimantic:* Boston Grain Co.	9.70	3.63	17.81	17.00	5.50	5.00	57.81	5.55	5.00
	Wheat Red Dog.										
5955	*Elmore Red Dog Flour Middlings.* Elmore Milling Co., Oneonta, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	11.50	2.47	15.50	15.00	2.70	6.00	64.25	3.58	4.00
4810	*Red Dog Flour.* Maritime Milling Co., Buffalo, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	11.59	3.48	17.38	16.00	4.29	4.00	58.16	5.10	4.00
5304	*Gold Medal Adrian Red Dog.* Washburn-Crosby Co., Minneapolis, Minn.	*Rockville:* Rockville Grain & Coal Co.	11.15	2.45	17.00	16.00	1.85	4.00	63.82	3.73	3.50
	Wheat Feed (Mixed Feed).										
5637	*Wingold Fancy Pure.* Bay State Milling Co., Winona, Minn.	*Torrington:* D. L. Talcott	8.98	4.83	16.69	16.20	6.90	8.10	57.75	4.85	4.20
5750	*Dairy Maid.* Federal Milling Co., Lockport, N. Y.	*Putnam:* Bosworth Bros.	9.98	4.69	14.94	15.50	6.88	8.00	59.11	4.40	4.00
5425	*"Gold Mine."* King Flour Mills Co., Minneapolis, Minn.	*Hartford:* C. A. Pease & Co.	10.43	5.34	18.75	15.00	7.03	9.50	53.72	4.73	4.50
6252	*Red Star.* E. Manchester & Sons, Winsted	*Thomaston:* Thomaston Supply Co.	10.20	3.94	17.56	16.00	6.38	7.50	57.24	4.68	4.00
5577	*Bull.* Maritime Milling Co., Buffalo, N. Y.	*New Milford:* Geo. E. Ackley & Co.	9.68	4.25	15.81	15.00	7.86	8.00	57.07	5.33	4.00
5396	*Red Wing.* Meech & Stoddard, Middletown	*East Hartford:* Meech Grain Co.	9.73	4.83	16.19	15.00	7.20	10.00	56.95	5.10	4.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	WHEAT PRODUCTS—*Concluded*										
	Wheat Feed (Mixed Feed)—Concluded.										
5647	*Moon's.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Norfolk:* Aug. P. Curtis	9.96	4.53	16.13	14.00	6.25	10.00	58.83	4.30	4.00
5380	*Osota.* National Milling Co., Toledo, Ohio	*Bloomfield:* Bloomfield Farmers' Exchange	9.83	4.51	15.75	15.00	6.58	10.00	58.80	4.53	4.50
5268	*XXX Comet.* Northwestern Consolidated Milling Co., Minneapolis, Minn.	*Bloomfield:* Bloomfield Farmers' Exchange	11.13	2.92	18.31	16.00	2.10	4.00	60.56	4.98	4.00
5213	*Planet.* Northwestern Consolidated Milling Co., Minneapolis, Minn.	*North Haven:* W. L. Thorpe	11.20	4.73	18.31	15.00	6.23	8.00	54.55	4.98	4.00
5210	Northwestern Consolidated Milling Co., Minneapolis, Minn.	*North Haven:* W. L. Thorpe	11.08	5.25	17.31	15.00	7.50	8.50	53.71	5.15	4.00
5713	*Papco.* Park & Pollard Co., Buffalo, N. Y.	*Woodbury:* C. L. Adams Co.	9.33	5.46	15.38	15.10	8.30	9.50	56.55	4.98	5.30
6251	*Papco.* Park & Pollard Co., Buffalo, N. Y.	*Woodbury:* C. L. Adams Co.	11.00	5.62	17.88	15.10	7.97	9.50	53.28	4.25	5.30
5434	*Pillsbury's with Screenings.* Pillsbury Flour Mills, Minneapolis, Minn.	*Granby:* E. H. Rollins	10.50	4.12	16.81	15.00	5.79	8.50	58.03	4.75	4.00
5226	*XX Daisy.* Pillsbury Flour Mills,										

5678	*Pretty Special.* Park & Pollard Co., Buffalo, N. Y.	*Putnam:* Bosworth Bros.	9.25	3.98	16.00	16.00	7.75	9.00	58.24	4.78	4.00
5902	*Buckeye.* Quaker Oats Co., Chicago, Ill.	*Kensington:* I. F. Labieniec	11.95	5.71	16.44	15.50	7.55	10.00	53.75	4.60	4.50
5225	*Occident.* Russell-Miller Milling Co., Minneapolis, Minn.	*Wallingford:* A. E. Hall	10.85	4.84	17.06	15.00	7.30	9.50	54.50	5.45	4.50
5661	*Wirthmore.* St. Albans Grain Co., St. Albans, Vt.	*So. Coventry:* E. W. Latimer	9.23	4.37	16.00	15.00	6.30	8.00	59.62	4.48	4.50
6264	*T. & C.* Thornton & Chester Milling Co., Buffalo, N. Y.	*Andover:* E. A. Standish	10.58	5.05	16.69	15.00	7.99	10.00	54.83	4.86	5.00
5800	*Gold Medal.* Washburn-Crosby Co., Minneapolis, Minn.	*Manchester:* Manchester Grain Co.	11.05	4.17	15.88	16.00	4.95	7.50	60.02	3.93	4.00
5745	*Big Y.* Yantic Grain & Products Co., Norwich	Sampled at factory	9.45	5.19	17.25	16.00	7.38	7.00	55.70	5.03	4.50
	Maize Products.										
	Corn Gluten Feed.										
5655	American Maize Products Co., New York City	*Stratford:* Z. C. Ingersoll	7.13	3.83	26.50	23.00	7.20	8.50	50.61	4.73	2.00
5484	*Clinton.* Clinton Corn Syrup Refining Co., Clinton, Iowa	*Seymour:* Seymour Grain & Coal Co.	8.53	4.60	25.63	23.00	6.45	8.50	51.47	3.32	2.00
5254	*Buffalo.* Corn Products Refining Co., New York City	*Suffield:* Spencer Bros.	8.93	4.35	26.13	23.00	7.13	8.50	49.63	3.83	2.00
5323	*Diamond.* Corn Products Refining Co., New York City	*East Haven:* A. W. Forbes	9.88	1.11	44.81	40.00	1.78	4.00	40.49	1.93	1.00
5653	*Keokuk.* J. C. Hubinger Bros. Co., Keokuk, Iowa	*Devon:* Devon Coal & Ice Co.	7.41	3.56	23.25	23.00	7.68	8.50	50.65	7.45	2.00
5269	*Douglas* (Meal). Penick & Ford, Ltd., Cedar Rapids, Iowa	*Bloomfield:* Bloomfield Farmers' Exchange	8.25	3.22	41.63	40.00	3.33	4.00	40.59	2.98	1.00
5318	*Douglas.* Penick & Ford, Ltd., Cedar Rapids, Iowa	*Rockville:* Rockville Grain & Coal Co.	9.00	7.42	26.75	23.00	7.54	8.00	46.74	2.55	1.00
5180	*Staley's.* A. E. Staley Mfg. Co., Decatur, Ill.	*West Cheshire:* Cheshire Grain & Coal Co.	8.45	4.53	25.63	23.00	6.90	8.00	52.09	2.40	1.00
6207	*Union.* Union Starch & Refining Co., Columbus, Ind.	*New London:* Paty Schwartz Co.	7.43	6.93	26.44	23.00	7.29	8.00	49.28	2.63	1.00

TABLE 1. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	MAIZE PRODUCTS—*Concluded.* *Hominy Feed.*										
5628	Aunt Jemima Mill Branch (Quaker Oats Co.), St. Joseph, Mo.	*Warehouse Point:* C. T. Lewis	8.65	2.90	11.00	10.00	5.53	8.00	65.52	6.40	5.00
5844[1]	*Cereal* Mills Co., Wausau, Wis.	*New London:* New London Grain Co.	8.08	2.65	12.69	10.00	4.55	5.00	64.60	7.43	5.00
5186	*Homco.* Decatur Milling Co., Decatur, Ill.	*Plantsville:* C. A. Cowles	9.93	2.67	11.25	10.00	5.13	6.00	62.64	8.38	7.00
5590	Elevator Milling Co., Springfield, Ill.	*Thomaston:* Thomaston Supply Co.	10.15	2.76	11.50	10.00	4.73	6.00	63.91	6.95	7.00
5829	*Emco.* Evans Milling Co., Indianapolis, Ind.	*Ridgefield:* Ridgefield Lumber Co.	9.35	2.96	11.94	10.00	4.93	6.00	63.14	7.68	7.00
5169	*Kellogg's.* Kellogg Co., Battle Creek, Mich.	*West Cheshire:* Cheshire Grain & Coal Co.	9.18	2.51	11.13	10.00	4.53	5.00	65.80	6.85	6.00
5857	*Sonny South.* Louisville Milling Co., Louisville, Ky.	*Plantsville:* C. A. Cowles	8.70	2.54	10.88	10.00	4.60	6.00	67.15	6.13	7.00
5255	*Sonny South.* Louisville Milling Co., Louisville, Ky.	*Plantsville:* C. A. Cowles	8.53	2.86	10.88	10.00	4.40	6.00	67.53	5.80	7.00
5224	*Steam Cooked.* Miner-Hillard Milling Co., Wilkes-Barre, Pa.	*Wallingford:* A. E. Hall	10.48	2.15	10.88	10.00	3.83	5.00	67.88	4.78	4.00
5687	*Poco.* Mt. Vernon Milling Co., Mt. Vernon, Ind.	*Willimantic:* Willimantic Grain Co.	7.90	2.64	11.00	10.00	4.63	6.00	65.61	8.22	7.00

[1] Wire tags illegal

5164	Patent Cereals Co., Geneva, N. Y.	*Hamden:* Ira W. Beers	10.78	2.77	11.25	10.00	4.50	5.00	66.02	**4.68**	5.00
5658	Patent Cereals Co., Geneva, N. Y.	*Farmington:* Winchell Smith, Inc.	9.94	2.65	11.06	10.00	4.83	5.00	66.13	5.39	5.00
5182	*Burt's.* Postum Cereal Co., Inc., Battle Creek, Mich.	*Plantsville:* Mehmel & Sarvi ...	11.05	2.35	10.63	10.00	3.73	5.00	66.11	6.13	6.00
6236	*Pratt's White.* Pratt Food Co., Buffalo, N. Y.	*Danbury:* C. S. Barnum & Son	11.73	2.37	10.31	10.00	3.58	6.00	66.91	5.10	5.00
5552	*White.* Quaker Oats Co., Chicago, Ill.	*Waterbury:* H. S. Coe & Co., Inc.	11.13	1.31	**9.38**	10.50	2.93	6.00	71.77	**3.48**	5.00
5549	*Yellow.* Quaker Oats Co., Chicago, Ill.	*Waterbury:* H. S. Coe & Co., Inc.	10.40	2.37	10.50	10.50	3.60	6.00	67.85	5.28	5.00
5721	*Paragon.* St. Albans Grain Co., St. Albans, Vt.	*Brooklyn:* C. G. Lawton	9.28	3.87	10.56	10.00	4.50	7.00	65.06	6.73	6.00
	RYE PRODUCTS.										
5636	*Wingold Middlings with Screenings.* Bay State Milling Co., Winona, Minn.	*Torrington:* D. L. Talcott	8.88	3.76	16.81	16.60	5.48	7.40	61.27	3.80	3.50
5228	*Middlings.* Miner-Hillard Milling Co., Wilkes-Barre, Pa. ...	*Wallingford:* A. E. Hall	10.90	3.41	15.88	12.00	3.50	5.00	63.41	2.90	2.50
6315	*Irving Mills Feed.* Van Vechten Milling Co., Rochester, N. Y.	*Higganum:* F. A. Petrofsky ...	9.98	3.29	16.00	13.00	3.40	10.00	64.45	2.88	2.00
	BREWERS' AND DISTILLERS' GRAINS.										
5841	*Dried Brewers' Grains.* Farmers' Feed Co., Buffalo, N. Y.	*Plantsville:* C. A. Cowles	3.78	2.89	30.31	22.00	10.53	15.00	43.09	9.40	6.00
6014	*Alco Distillers' Grains.* C. J. Martenis Grain Co., New York	*Plantsville:* C. A. Cowles	5.50	1.60	28.75	25.00	10.95	15.00	44.17	9.03	5.00
5216	*Dried Brewers' Grains.* St. Albans Grain Co., St. Albans, Vt.	*Kensington:* I. F. Labieniec	8.70	3.40	**21.25**	23.00	12.48	13.50	47.67	6.50	6.00
5802	*Dried Brewers' Grains.* St. Albans Grain Co., St. Albans, Vt.	*Guilford:* F. C. Morse & Son ..	5.43	3.94	23.25	23.00	13.18	13.50	46.90	7.30	6.00
	DRIED BEET PULP.										
5229	Larrowe Milling Co., Detroit, Mich.	*Wallingford:* A. E. Hall	8.08	4.03	10.50	8.00	17.95	22.00	58.51	0.93	0.50
6272	*Molasses Beet Pulp.* Larrowe Milling Co., Detroit, Mich. ...	*Putnam:* Dayville Grain Co. ...	8.53	6.38	7.69	8.00	13.90	20.00	62.90	0.60	0.50

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	PROPRIETARY MIXED FEEDS.										
	Horse Feed, etc.										
4882	*Amco.* American Milling Co., Peoria, Ill.	*Stamford:* Francis H. Leggett & Co.	5.21	5.05	11.75	10.00	6.53	10.00	68.59	2.87	2.50
5518	*Beacon.* Beacon Milling Co., Cayuga, N. Y.	*New Milford:* W. L. Richmond & Son	6.38	4.02	10.44	9.00	5.55	11.00	70.21	3.40	2.50
5757	*Provender.* C. W. Campbell Co., Westerly, R. I.	Sampled at factory	9.18	2.34	11.38	10.00	6.08	9.00	65.82	5.20	4.00
5351	*Co-Pro-Co.* Corn Products Refining Co., New York City	*Wallingford:* Laden Bros.	8.10	4.65	9.50	8.00	10.80	12.00	63.95	3.00	2.50
5516	*Davis.* R. G. Davis & Sons, New Haven	*Westville:* Davis Feed Store	5.50	3.29	10.75	9.00	7.70	10.00	68.53	4.23	3.00
5805	*Davis No. 1 Provender.* R. G. Davis & Sons, New Haven	Sampled at factory	9.40	2.82	10.94	10.00	8.28	8.00	64.71	3.85	3.50
5495	*Alfalfa Meal.* Denver Alfalfa Milling Co., Lamar, Colo.	*Torrington:* F. L. Wadhams	7.74	9.57	14.44	12.00	28.10	35.00	38.22	1.93	1.00
6409	*Alfalfa Leaf Meal.* Denver Alfalfa Milling Co., Lamar, Colo.	*Plainville:* W. S. Eaton	8.53	10.04	19.94	20.00	19.10	18.00	39.85	2.54	2.50
3645	*Elmore, with Molasses.* Elmore Milling Co., Oneonta, N. Y.	*Beacon Falls:* Edward Gruber	7.31	3.19	9.88	9.00	7.30	11.00	69.79	2.53	2.50
5545	*Elmore, with Molasses.* Elmore Milling Co., Oneonta, N. Y.	*Beacon Falls:* Edward Gruber	6.95	4.60	10.38	9.00	7.53	11.00	67.17	3.37	2.50
5297	*Red Rose 85.* John W. Eshelman & Son, Lancaster, Pa.	*Manchester:* Little & McKinney	9.63	3.55	10.06	9.00	7.55	10.00	65.23	3.98	3.00

5385	*Lancaster 60.* John W. Eshelman & Son, Lancaster, Pa.	*Simsbury:* Woods Chandler Co.	9.03	5.92	10.50	9.00	9.95	10.00	61.42	3.18	2.50
4116	*Liberty.* John W. Eshelman & Son, Lancaster, Pa.	*Bridgeport:* Federal Grain Corp.	6.48	8.25	9.88	7.00	9.65	10.00	62.51	3.23	2.00
5387	*Liberty.* John W. Eshelman & Son, Lancaster, Pa.	*Shelton:* Wolf Savinsky	7.95	7.69	8.56	7.00	9.88	10.00	63.54	2.38	2.00
5381	*Thorobred.* John W. Eshelman & Son, Lancaster, Pa.	*Manchester:* Little & McKinney	9.30	1.81	10.63	9.50	3.65	4.00	70.13	4.48	4.00
5847	*Garden Spot.* John W. Eshelman & Son, Lancaster, Pa. ..	*Norwalk:* Frank Libner & Son	8.65	5.73	8.63	7.00	7.08	10.00	67.21	2.70	2.00
5652	*Vio.* Flory Milling Co., Bangor, Pa.	*Long Hill:* Long Hill Feed Store	4.69	10.30	9.69	6.00	10.98	12.00	61.44	2.90	2.00
6262	*Bronco.* Grain Belt Mills Co., St. Joseph, Mo.	*Middletown:* Meech & Stoddard, Inc.	13.10	8.87	9.69	9.00	12.00	15.00	54.71	1.63	2.00
6413	*Bronco.* Grain Belt Mills Co., St. Joseph, Mo.	*Middletown:* Meech & Stoddard, Inc.	11.48	9.28	10.19	9.00	12.50	15.00	54.92	1.63	2.00
5801	*Algrane.* Hecker H-O Co., Buffalo, N. Y.	*Westerly:* C. W. Campbell Co...	9.43	4.88	10.31	10.00	10.08	10.00	61.72	3.58	3.00
5188	*Re-Ground Oat.* Hecker H-O Co., Buffalo, N. Y.	*Plantsville:* C. A. Cowles	6.38	6.31	6.94	5.00	24.68	28.00	52.91	2.78	2.00
5366	*Imperial.* Imperial Grain & Milling Co., Toledo, Ohio	*Middletown:* Meech & Stoddard, Inc.	11.40	2.08	9.81	9.50	4.83	4.00	67.43	4.45	4.00
5886	*Imperial.* Imperial Grain & Milling Co., Toledo, Ohio	*East Hartford:* Meech Grain Co.	10.88	2.05	10.38	9.50	4.33	4.00	67.83	4.53	4.00
5845	*Green Velvet.* Meader Milling Co., Hoboken, N. J.	*East Bridgeport:* Kaplan Feed Co.	6.25	10.35	12.00	9.00	16.43	20.00	54.39	0.58	0.50
5846	*Monogram.* Meader Milling Co., Hoboken, N. J.	*East Bridgeport:* Kaplan Feed Co.	7.28	7.07	15.94	12.00	10.98	12.00	55.48	3.25	2.00
5357	*Red Wing, with Molasses.* Meech & Stoddard, Inc., Middletown	Sampled at factory	9.35	3.73	10.25	9.00	7.93	10.00	64.41	4.33	3.00
6314	*"1795" Steam Cooked Corn and Oats.* Miner-Hillard Milling Co., Wilkes-Barre, Pa.	*Westerly:* C. W. Campbell Co...	9.73	2.14	10.25	9.50	5.03	5.00	68.42	4.43	4.00
5650	*Old Time.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Norfolk:* Aug. P. Curtis	10.70	2.38	11.25	8.50	6.70	9.00	64.34	4.63	4.50
5335	*Old Mill Provender.* Fred C. Morse, Guilford	Sampled at factory	10.55	2.45	10.50	10.00	5.55	7.00	66.42	4.53	4.00

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	Proprietary Mixed Feeds—*Continued.*										
	Horse Feeds—Concluded.										
5553	*Domino Vim-O-Lene.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	5.45	2.75	11.50	8.00	6.50	9.00	69.85	3.95	2.00
5325	*Osborn Provender.* S. V. Osborn Est., Branford	Sampled at factory	11.38	2.28	9.75	10.00	8.00	8.00	64.69	3.90	4.00
5671	*Arlington.* Park & Pollard Co., Buffalo, N. Y.	*West Stafford:* C. P. Bradway	4.33	4.81	10.94	9.00	8.60	11.00	66.76	4.56	2.50
5548	*Chelsea.* Park & Pollard Co., Buffalo, N. Y.	*Waterbury:* Spencer Grain Co.	6.70	8.21	9.31	8.00	12.58	12.00	61.22	1.98	2.00
4871	*Herdhelth.* Park & Pollard Co., Buffalo, N. Y.	*Newtown:* R. H. Holcomb Co.	5.08	10.53	18.31	16.00	11.47	12.00	49.95	4.66	6.00
5541	*Herdhelth.* Park & Pollard Co., Buffalo, N. Y.	*Newtown:* R. H. Holcomb Co.	6.98	10.14	18.63	16.00	11.63	12.00	49.04	3.58	6.00
6250	*Herdhelth.* Park & Pollard Co., Buffalo, N. Y.	*Newtown:* R. H. Holcomb Co.	12.58	9.17	15.31	16.00	10.64	12.00	48.00	4.30	4.00
4811	*Green Cross.* Quaker Oats Co., Chicago, Ill.	*Thompsonville:* Geo. S. Phelps & Co.	9.39	5.63	11.94	10.00	11.43	12.00	58.97	2.64	2.50
5204	*Green Cross.* Quaker Oats Co., Chicago, Ill.	*Thompsonville:* Geo. S. Phelps & Co.	8.25	6.21	12.13	10.00	11.10	12.00	59.86	2.45	2.50
5160	*Vim.* Quaker Oats Co., Chicago, Ill.	*Plantsville:* C. A. Cowles	6.33	6.93	6.25	5.00	25.35	28.00	53.21	1.93	2.00

	Mills, St. Louis, Mo.	*Derby:* Peterson-Hendee Co. ..	7.58	9.10	13.75	9.00	14.00	15.00	52.79	2.18	2.00
5364	*Purina Bulky Las.* Ralston Purina Mills, St. Louis, Mo.	*Middletown:* H. G. Wadhams Co.	8.75	9.49	12.31	9.00	11.18	15.00	56.83	1.44	2.00
5720	*Purina Bulky Las.* Ralston Purina Mills, St. Louis, Mo.	*New Haven:* Moran-Patton Co.	6.35	7.92	11.00	9.00	14.83	15.00	58.15	1.75	2.00
5419	*Purina O-Molene.* Ralston Purina Mills, St. Louis, Mo.	*Unionville:* F. D. Lawton & Son	9.00	3.95	11.00	9.70	6.74	9.00	64.46	4.85	3.20
5808	*Special Rosebro.* Rosenbaum Bros., Chicago, Ill.	*East Bridgeport:* Kaplan Feed Co.	4.78	5.22	10.13	10.00	9.05	11.00	66.72	4.10	2.00
5305	*Syragold, with Molasses.* Syracuse Milling Co., Syracuse, N. Y.	*Rockville:* Rockville Milling Co.	9.23	4.81	11.25	8.00	8.00	12.00	63.56	3.15	2.50
5760	*Jordan, with Molasses.* Syracuse Milling Co., Syracuse, N. Y. ..	*So. Norwalk:* Roodner Feed Co.	5.05	5.39	9.88	7.00	11.50	12.00	65.04	3.14	2.00
5591	*Derby Corn and Oat Feed.* Tioga Mill & Elevator Co., Waverly, N. Y.	*Hawleyville:* W. A. Honan	11.15	2.28	10.50	9.20	5.08	8.00	66.14	4.85	4.00
6572	*Derby Meal.* Tioga-Empire Feed Mill, Waverly, N. Y.	*Hawleyville:* W. A. Honan	13.83	1.42	9.00	9.02	2.63	3.50	68.87	4.25	3.06
	Dairy Feeds.										
5170	*Claco.* C. L. Adams Co., Woodbury	*West Cheshire:* Cheshire Grain & Coal Co.	9.83	7.14	21.50	20.00	8.68	9.00	47.60	5.25	5.00
5400	*Amco 20% Empire.* American Milling Co., Peoria, Ill.	*Farmington:* T. E. Stephenson..	8.83	7.64	21.63	20.00	7.61	9.00	49.76	4.53	4.50
5895	*Amco 24% Universal.* American Milling Co., Peoria, Ill.	*Stamford:* Clapboard Hill Feed Co.	9.00	8.75	25.50	24.00	6.93	9.00	44.84	4.98	5.00
4877	*Empire.* American Milling Co., Peoria, Ill.	*Middletown:* Chas. Dragoo	7.05	7.25	22.56	20.00	6.31	9.00	51.92	4.91	4.00
4881	*Universal.* American Milling Co., Peoria, Ill.	*Stamford:* Francis H. Leggett & Co.	8.60	8.06	24.56	24.00	8.80	9.00	44.85	5.13	5.00
5437	*Advanced Registry.* Arcady Farms Milling Co., Chicago, Ill.	*Simsbury:* Woods Chandler Co.	9.43	4.68	22.88	25.00	8.65	10.00	49.01	5.35	5.00
5865	*Advanced Registry.* Arcady Farms Milling Co., Chicago, Ill.	*Simsbury:* Woods Chandler Co.	8.58	6.12	24.88	25.00	8.25	10.00	47.09	5.08	5.00

—Continued.

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	Proprietary Mixed Feeds—*Continued.*										
	Dairy Feeds—Continued.										
5373	***Peerless Milk Ration.*** Arcady Farms Milling Co., Chicago, Ill.	*So. Manchester:* Smith Bros.	8.98	8.01	16.75	20.00	11.60	12.00	50.75	3.91	4.00
5374	***Sweet 16.*** Arcady Farms Milling Co., Chicago, Ill.	*So. Manchester:* Smith Bros.	9.35	7.89	16.69	16.00	11.89	12.00	50.30	3.88	4.00
5822	***Wonder.*** Arcady Farms Milling Co., Chicago, Ill.	*Plantsville:* Mehmel & Sarvi	7.38	6.03	27.00	24.00	9.13	10.00	45.06	5.40	5.00
6266	***Bailey's Open Formula 20%.*** E. W. Bailey & Co., Montpelier, Vt.	*Mansfield Depot:* M. M. Hanson	10.90	7.52	21.13	20.00	8.55	9.00	47.25	4.65	4.50
5669	***Capitol.*** E. W. Bailey & Co., Montpelier, Vt.	*Mansfield Depot:* M. M. Hanson	8.83	5.19	25.19	24.00	7.96	9.00	47.43	5.40	5.00
5677	***Favorite.*** E. W. Bailey & Co., Montpelier, Vt.	*West Willington:* H. M. Hanson	9.08	5.05	22.56	20.00	7.15	7.50	51.38	4.78	5.50
6265	***Favorite.*** E. W. Bailey & Co., Montpelier, Vt.	*West Willington:* H. M. Hanson	9.40	4.34	22.00	20.00	7.40	7.50	51.51	5.35	5.50
5467	***Auburn.*** Beacon Milling Co., Cayuga, N. Y.	*Derby:* Peterson-Hendee Co.	9.93	7.57	22.19	20.00	6.43	10.00	49.10	4.78	4.50
5519	***Beacon.*** Beacon Milling Co., Cayuga, N. Y.	*New Milford:* W. L. Richmond & Son	10.15	6.79	23.31	24.00	8.13	10.00	46.74	4.88	5.00
5166	***Beers.*** I. W. Beers, Hamden	Sampled at factory	10.18	4.76	20.63	19.00	8.18	8.00	51.55	4.70	3.75

[illegible]59	Success[illegible]. Amos D. Bridges Sons, Hazardville	Sampled at factory	10.00	4.93	22.38	20.00	8.28	9.50	49.21	5.20	5.20
6576	*C. B.* C. Buckingham Co., Southport	Sampled at factory	9.45	5.91	17.88	18.00	10.05	8.70	52.01	4.7[illegible]	4.80
5756	*No-Botheration.* C. W. Campbell Co., Westerly, R. I.	Sampled at factory	8.55	5.87	20.56	20.00	6.03	8.00	54.15	4.84	5.00
5198	Unicorn. Chapin & Co., Chicago, Ill.	*Plantsville:* C. A. Cowles	8.80	8.01	23.75	24.00	8.63	10.00	45.21	5.60	5.00
6201	*20% Dairy Ration.* The Coles Co., Middletown	Sampled at factory	8.30	5.15	23.00	20.00	8.93	10.00	49.59	5.03	4.00
6256	*24% Dairy Ration.* The Coles Co., Middletown	Sampled at factory	8.98	6.29	22.75	24.00	10.03	12.00	47.40	4.55	4.50
6598	*24% Dairy Ration.* The Coles Co., Middletown	Sampled at factory	9.97	5.06	19.50	24.00	9.43	12.00	51.59	4.45	4.50
5477	*Crosby's Balanced Ration.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savinsky	9.43	5.51	25.00	25.00	8.25	9.00	45.88	5.93	5.50
5833	*Crosby's 22%.* Crosby Milling Co., Brattleboro, Vt.	Sampled at factory	6.53	6.16	26.25	22.00	8.78	14.00	47.05	5.23	4.00
5594	*Cowles' 24% Dairy Ration.* C. A. Cowles, Plantsville	Sampled at factory	8.15	5.14	25.44	24.00	7.66	10.00	47.23	6.38	6.00
5475	*Crosby's Ready Ration.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savinsky	9.60	4.84	20.19	20.00	7.77	10.00	52.47	5.13	5.00
5481	*Basic Dairy Ration.* R. G. Davis & Sons, New Haven	*Ansonia:* Ansonia Flour & Feed Co.	10.05	5.39	21.56	20.00	7.70	9.00	50.05	5.25	4.50
5378	*Delaware Dairy Feed.* Delaware Mills, Deposit, N. Y.	*Southington:* Southington Lumber & Feed Co.	9.20	6.05	22.88	23.00	9.84	10.00	45.48	6.55	5.00
5719	*Devon.* Devon Coal & Ice Co., Devon	Sampled at factory	8.60	5.68	20.25	22.00	10.05	9.00	50.32	5.10	4.00
6235	*Devon.* Devon Coal & Ice Co., Devon	Sampled at factory	9.78	5.96	19.69	22.00	10.45	9.00	49.59	4.53	4.00
5490	*Eastern States Fitting Ration.* Eastern States Farmers' Exchange, Springfield, Mass.	*Seymour:* John Swan	10.09	6.71	15.69	15.00	6.85	8.00	55.72	4.94	3.50
5489	*Eastern States Full Pail Dairy Ration.* Eastern States Farmers' Exchange, Springfield, Mass.	*Seymour:* John Swan	8.37	8.01	21.88	20.00	7.15	9.00	49.11	5.48	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Dairy Feeds—Continued.										
5660	*Eastern States Milkmore Dairy Ration.* Eastern States Farmers' Exchange, Springfield, Mass.	*Farmington:* Albert Thompson..	7.78	7.53	24.56	24.00	7.15	9.00	46.90	6.08	4.50
5257	*Elmore Milk Grains.* Elmore Milling Co., Oneonta, N. Y. ..	*Thompsonville:* Geo. S. Phelps & Co.	8.40	5.09	26.00	25.00	9.33	11.00	45.48	5.70	5.00
5884	*Conestoga 18 Dairy Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Danbury:* F. C. Benjamin	8.88	8.25	21.38	18.00	**11.13**	10.00	44.48	5.88	3.50
5227	*Lancaster 20 Dairy Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Wallingford:* A. E. Hall	8.15	6.02	21.19	20.00	10.00	10.00	48.94	5.70	4.00
4803	*Pennsy 16 Dairy Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Stepney:* H. Goldman	16.48	7.60	17.31	16.00	**11.27**	10.00	43.13	4.21	3.00
5598	*Pennsy 16 Dairy Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Stepney:* M. Nusbaum	6.08	8.35	20.63	16.00	**10.78**	10.00	46.28	7.88	3.00
6530	*Pennsy 16 Dairy Feed.* John W. Eshelman & Son, Lancaster,										

	W. Eshelman & Son, Lancaster, Pa.	*Wallingford:* A. E. Hall	10.55	6.62	23.63	24.00	9.67	11.00	44.43	5.10	4.00
5512	*Globe Cow Feed.* Flory Milling Co., Bangor, Pa.	*Thomaston:* I. Levy	10.08	6.83	22.56	20.00	9.90	11.00	45.60	5.03	4.00
5601	*National Cow Feed.* Flory Milling Co., Bangor, Pa.	*Long Hill:* Long Hill Feed Store	6.78	7.34	18.31	16.50	10.93	11.00	52.59	4.05	3.50
5228	*R. Own Dairy Ration.* A. W. Forbes, East Haven	Sampled at factory	11.68	5.65	20.94	19.00	6.68	9.00	51.85	**3.20**	4.00
5809	*Algrane Milk Feed.* Hecker H-O Co., Buffalo, N. Y.	*So. Norwalk:* Roodner Feed Co.	8.00	5.84	17.00	16.00	10.03	15.00	55.05	4.08	4.00
4870	*Holcomb's Special.* R. H. Holcomb, Newtown	Sampled at factory	8.50	8.39	21.44	22.00	**13.18**	12.00	44.32	4.17	4.00
5629	*"Hudson's" Cow Feed.* L. W. Hudson, Windsor	Sampled at factory	8.55	5.29	19.44	20.00	7.98	8.00	53.54	**5.20**	5.50
3718	*"Hudson's" Cow Feed.* L. W. Hudson, Windsor	Sampled at factory	8.18	5.78	20.06	20.00	7.65	8.17	52.43	5.90	5.91
6313	*International Diamond.* International Sugar Feed Co., Minneapolis, Minn.	*Putnam:* Dayville Grain Co.	11.45	9.22	**21.44**	24.00	**11.08**	10.00	41.63	5.18	5.00
6311	*International Ready Ration.* International Sugar Feed Co., Minneapolis, Minn.	*Putnam:* Dayville Grain Co.	11.55	8.66	21.88	20.00	10.83	11.50	41.90	5.18	5.00
6312	*International Special.* International Sugar Feed Co., Minneapolis, Minn.	*Putnam:* Dayville Grain Co.	12.28	8.84	14.69	15.00*	**13.03**	12.00	45.57	5.59	4.50
5644	*Apex Milk Maker.* Kasco Grain Mills, Waverly, N. Y.	*East Winsted:* Leonard Grain Co.	9.15	5.24	20.81	20.00	8.98	11.00	50.74	5.08	4.50
5645	*Beatsall Milk Grains.* Kasco Grain Mills, Waverly, N. Y.	*East Winsted:* Leonard Grain Co.	10.46	5.63	23.19	22.00	8.93	10.00	47.71	**4.08**	4.50
6016	*Beatsall Milk Grains.* Kasco Grain Mills, Waverly, N. Y.	*East Winsted:* Leonard Grain Co.	9.18	5.49	23.38	22.00	8.28	10.00	48.34	5.33	4.50
5153	Larro. Larrowe Milling Co., Detroit, Mich.	*Highwood:* T. C. Hadden & Co.,	9.28	5.50	21.19	20.00	10.23	12.00	49.57	4.23	4.00
5370	*Millpride Dairy Ration.* C. W. Lines Co., New Britain	Sampled at factory	9.63	6.41	26.69	24.00	7.50	10.00	44.77	**5.00**	5.50
5890	*Millpride Dairy Ration.* C. W. Lines Co., New Britain	Sampled at factory	8.85	6.53	26.94	24.00	7.00	10.00	44.93	5.75	5.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Dairy Feeds—Continued.										
5996	*Common-Sense Dairy Ration.* Litchfield Co-op. Assoc., Torrington	Sampled at factory	8.50	6.50	21.88	20.00	7.80	9.50	49.90	5.42	5.00
3636	*Common-Sense Dairy Ration.* Litchfield Co-op. Assoc., Torrington	Sampled at factory	8.40	6.67	20.88	20.00	8.33	9.50	50.38	5.34	5.00
5599	*Square Deal Dairy Ration.* Long Hill Feed Store, Long Hill	Sampled at factory	8.60	6.96	21.88	20.00	9.25	10.00	48.31	5.00	5.00
5574	*Red Star.* E. Manchester & Sons, Winsted	Sampled at factory	8.80	6.56	24.00	23.00	8.14	10.00	47.22	5.28	4.00
5223	*Bull Brand.* Maritime Milling Co., Buffalo, N. Y.	*North Haven:* W. L. Thorpe	8.85	7.75	23.56	24.00	10.25	12.00	44.06	5.53	6.00
5714	*Bull Brand.* Maritime Milling Co., Buffalo, N. Y.	*Riverton:* L. A. Coe	8.68	6.64	24.00	24.00	9.83	12.00	45.05	5.80	6.00
5722	*Hi-Test.* Maritime Milling Co., Buffalo, N. Y.	*Colchester:* P. Cutler, Inc.	7.75	8.18	20.88	20.00	10.88	12.00	47.16	5.15	5.00
5232	*Red Wing.* Meech & Stoddard, Inc., Middletown	*Meriden:* Meriden Grain & Coal Co.	8.40	6.89	21.06	20.00	8.03	9.00	49.07	6.55	5.50
5183	*Red Wing Special.* Meech & [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

5648	*Moon's 24% Dairy Ration.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Norfolk:* Aug. P. Curtis	9.07	5.41	26.13	24.00	7.48	10.00	46.41	5.50	5.00
5333	*Old Mill Dairy Ration.* Fred C. Morse, Guilford	Sampled at factory	8.70	6.63	23.06	23.00	8.83	9.00	46.68	6.10	5.00
5347	*Domino 24 1-2 Dry Dairy Feed.* Nowak Milling Corp., Hammond, Ind.	*Higganum:* F. A. Petrofsky	8.43	7.75	24.13	24.50	9.35	10.00	45.39	4.95	5.00
5555	*Domino 32% Protein.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	8.75	8.56	30.88	32.00	8.86	10.00	38.25	4.70	4.50
5392	*Hammond.* Nowak Milling Corp., Hammond, Ind.	*Manchester:* I. P. Campbell	6.25	11.76	17.81	16.50	11.28	13.50	46.97	5.93	4.00
5393	*Marathon.* Nowak Milling Corp., Hammond, Ind.	*Manchester:* I. P. Campbell	9.15	6.70	22.38	22.00	10.00	12.00	46.59	5.18	4.00
5550	*Uncle John's Cream Pot Ration.* Ontario Milling Co., Oswego, N. Y.	*Waterbury:* H. S. Coe & Co., Inc.	8.50	6.20	24.25	24.00	7.53	9.00	47.24	6.28	5.50
6270	*Bet-R-Milk Ration.* Park & Pollard Co., Buffalo, N. Y.	*Putnam:* Bosworth Bros.	11.25	9.39	21.00	20.00	10.23	10.00	40.60	7.53	5.00
5168	*Milk Maid 24% Dairy Ration.* Park & Pollard Co., Buffalo, N. Y.	*West Cheshire:* Cheshire Grain & Coal Co.	8.58	9.65	24.50	24.00	11.80	11.00	40.37	5.10	5.00
5668	*Milk Maid 24% Dairy Ration.* Park & Pollard Co., Buffalo, N. Y.	*So. Coventry:* E. W. Latimer	9.18	8.56	24.44	24.00	11.25	11.00	41.17	5.40	5.00
5679	*The Park & Pollard Co. 16% Dairy Ration.* Park & Pollard Co., Buffalo, N. Y.	*Moosup:* T. E. Main & Sons	8.43	8.87	17.63	16.00	10.30	14.00	50.62	4.15	5.00
5540	*The Park & Pollard Co. 20% Dairy Ration.* Park & Pollard Co., Buffalo, N. Y.	*Newtown:* R. H. Holcomb Co.	8.78	8.56	21.44	20.00	9.37	12.00	47.22	4.63	5.00
5882	*The Park & Pollard Co. 20% Dairy Ration.* Park & Pollard Co., Buffalo, N. Y.	*Putnam:* Bosworth Bros.	9.70	9.00	20.00	20.00	8.50	12.00	48.30	4.50	5.00
5539	*Stevens "44" Sweetened Dairy Ration.* Park & Pollard Co., Buffalo, N. Y.	*Southbury:* H. R. Stone	7.98	8.44	23.63	24.00	9.26	12.00	45.76	4.93	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Dairy Feeds—Continued.										
5321	*Pillsbury Dairy Ration.* Pillsbury Flour Mills, Minneapolis, Minn.	*Rockville:* Rockville Milling Co.	9.88	7.10	21.31	20.00	8.45	10.00	48.18	5.08	5.00
5439	*Burt's Cereal Feed.* Postum Cereal Co., Battle Creek, Mich.	*Weatogue:* R. B. Eno	7.88	3.96	20.19	17.00	15.75	20.00	47.38	4.84	3.00
5435	*Burt's Dairy Feed.* Postum Cereal Co., Battle Creek, Mich.	*Granby:* E. H. Rollins	8.18	6.19	23.25	24.00	7.80	9.00	49.44	5.14	5.00
6263	*A. D. P. 24% Dairy Ration.* W. N. Potter & Son, Greenfield, Mass.	*Andover:* E. A. Standish	10.15	6.40	24.06	24.00	6.28	10.00	49.06	4.05	4.00
6003	*Armour's 24% Dairy Feed.* Pratt Food Co., Buffalo, N. Y.	*Danbury:* C. S. Barnum & Sons	7.43	8.29	20.44	24.00	12.65	12.00	45.64	5.55	5.00
5295	*Producer.* H. C. Puffer Co., Springfield, Mass.	*Bloomfield:* Bloomfield Farmers' Exchange	9.83	6.21	25.50	24.00	7.18	10.00	45.60	5.68	3.50
5154	*Big Q Dairy Ration.* Quaker Oats Co., Chicago, Ill.	*Highwood:* T. C. Hadden & Co.	8.30	7.90	20.25	20.00	11.30	12.00	48.10	4.15	3.25
5264	*Boss.* Quaker Oats Co., Chicago, Ill.	*Warehouse Point:* C. T. Lewis	8.50	7.54	24.88	24.00	9.15	10.50	44.50	5.43	4.00

5263	*Quaker 16% Ration.* Quaker Oats Co., Chicago, Ill.	*Warehouse Point:* C. T. Lewis	8.70	8.41	16.13	16.00	13.38	13.50	48.68	4.70	4.00
5568	*Protena.* Ralston Purina Co., St. Louis, Mo.	*Litchfield:* Wadhams Co.	9.40	7.09	18.94	16.50	11.45	12.00	49.17	3.95	3.50
5363	*Purina Cow Chow.* Ralston Purina Co., St. Louis, Mo.	*Middletown:* H. G. Wadhams Co.	9.58	6.65	25.94	24.00	10.18	12.00	42.82	4.83	4.00
5838	*Diamond.* Rockville Grain & Coal Co., Rockville	Sampled at factory	7.50	6.78	24.69	24.00	9.45	10.00	46.33	5.25	5.00
5693	*Advance.* Rosenbaum Bros., Chicago, Ill.	*Danielson:* Dayville Grain Co	8.33	8.67	17.88	16.00	11.03	14.00	47.14	6.95	3.50
6008	*Will Pay Dairy Ration.* Rosenbaum Bros., Chicago, Ill.	*Thompsonville:* Geo. S. Phelps & Co.	9.25	8.96	20.69	20.00	8.40	9.00	48.37	4.33	5.00
5858	*Homespun Dairy Ration.* Paty Schwartz Co., New London	Sampled at factory	8.15	5.32	23.13	22.00	9.48	10.00	49.69	4.23	4.00
5486	*See-More-Milk Dairy Ration.* Seymour Grain & Coal Co., Seymour	Sampled at factory	9.28	5.91	21.88	20.00	7.74	8.00	49.80	5.39	4.50
5414	*Mill Streams Boomerang.* Winchell Smith, Inc., Farmington	Sampled at factory	9.45	5.14	22.06	24.00	5.97	10.00	52.50	4.88	6.00
5863	*Mill Streams Boomerang.* Winchell Smith, Inc., Farmington	Sampled at factory	9.13	5.41	23.13	24.00	5.73	10.00	51.75	4.85	6.00
5415	*Mill Streams 20% Dairy Feed.* Winchell Smith, Inc., Farmington	Sampled at factory	9.30	5.89	20.38	20.00	7.65	8.00	52.15	4.63	5.00
5864	*Mill Streams 20% Dairy Feed.* Winchell Smith, Inc., Farmington	Sampled at factory	9.38	6.06	20.75	20.00	7.85	8.00	51.23	4.73	5.00
6267	*King Dairy Feed with Beet Pulp.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	10.28	5.21	21.56	21.00	9.60	11.00	48.80	4.55	4.50
5666	*King 22 Protein Milk Ration.* St. Albans Grain Co., St. Albans, Vt.	*Norwich:* Norwich Grain Co.	8.88	6.96	23.63	22.00	8.88	10.00	46.57	5.08	5.00
5583	*Paragon.* St. Albans Grain Co., St. Albans, Vt.	*Lakeville:* E. W. Spurr Co.	8.60	7.91	21.69	22.00	11.30	12.00	45.87	4.63	4.00
5159	*Wirthmore Balanced Dairy Ration.* St. Albans Grain Co., St. Albans, Vt.	*West Cheshire:* Cheshire Grain & Coal Co.	9.33	5.33	26.19	25.00	8.48	9.00	45.04	5.63	5.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Dairy Feeds—Concluded.										
5207	*Wirthmore 20% Dairy Feed.* St. Albans Grain Co., St. Albans, Vt.	*Plainville:* F. B. Newton	9.63	5.08	21.75	20.00	7.43	9.00	50.41	5.70	5.00
6247	*Jordan Sweet.* Syracuse Milling Co., Syracuse, N. Y.	*Southport:* C. Buckingham & Co.	10.78	6.50	16.63	16.00	11.38	12.00	50.03	4.68	3.00
5354	*Onondaga.* Syracuse Milling Co., Syracuse, N. Y.	*Middletown:* H. G. Wadhams Co.	8.33	6.28	22.75	20.00	11.10	12.00	46.20	5.34	4.00
5299	*Syragold.* Syracuse Milling Co., Syracuse, N. Y.	*Manchester:* Little & McKinney	8.95	4.67	25.00	24.00	10.00	12.00	45.13	6.25	4.50
5298	*Syragold Milk Ration.* Syracuse Milling Co., Syracuse, N. Y.	*Manchester:* Little & McKinney	9.20	5.17	22.00	20.00	9.68	12.00	48.60	5.35	4.00
4865	*Talcott's Economy Dairy Ration.* D. L. Talcott, Torrington	Sampled at factory	10.53	5.25	23.63	23.00	7.60	9.00	47.95	5.04	5.00
5496	*Talcott's Economy Dairy Ration.* D. L. Talcott, Torrington	Sampled at factory	8.58	6.01	24.88	23.00	8.23	9.00	47.32	4.98	4.50
3839	*Thomaston Dairy Ration.* Thomaston Supply Co., Thomaston	Sampled at factory	9.21	6.66	22.88	20.00	7.38	8.00	48.97	4.90	6.00
5500	*Thomaston Dairy.* Thomaston Supply Co., Thomaston	Sampled at factory	9.38	6.84	22.75	20.00	7.30	8.00	48.18	5.55	5.00
5342	*Red Brand.* Tioga Mill & Ele-	[illegible]	[illegible]		[illegible]		[illegible]				

5433	*Union Grains, Biles Ready Dairy Ration.* Ubiko Milling Co., Cincinnati, Ohio	*Hartford:* C. A. Pease & Co.	8.95	5.49	23.81	24.00	9.54	10.00	47.03	5.18	5.00
5466	*United Dairy Ration.* United Flour & Feed Co., Albany, N. Y.	*Weatogue:* R. B. Eno	9.68	5.72	24.31	24.00	9.12	11.00	45.82	5.35	5.00
5465	*Waldorf Milk Grains.* United Flour & Feed Co., Albany, N. Y.	*Windsor:* W. C. Everett	9.38	4.45	22.13	20.00	7.60	10.00	51.36	5.08	3.50
5633	*Wadfeeco Dairy Ration.* Wadsworth Feed Co., Warren, Ohio	*Shelton:* Shelton Feed Co.	8.80	6.54	24.88	24.00	7.58	9.00	46.90	5.30	5.00
5632	*Wadsworth Special Dairy Ration.* Wadsworth Feed Co., Warren, Ohio	*Shelton:* Shelton Feed Co.	8.18	6.38	23.63	20.00	10.95	12.00	45.83	5.03	5.00
5738	*Big Y Dairy Ration.* Yantic Grain & Products Co., Norwich	*Willimantic:* Boston Grain Co.	8.13	6.61	24.75	25.00	8.20	10.00	46.66	5.65	5.00
5742	*Echo.* Yantic Grain & Products Co., Norwich	*Norwich:* Greenville Grain Co.	7.60	6.79	24.63	24.00	11.68	12.00	44.00	5.30	4.50
6280	*Perfection.* Yantic Grain & Products Co., Norwich	Sampled at factory	8.90	6.93	21.81	22.00	13.18	13.00	44.54	4.64	4.50
5741	*Uncas.* Yantic Grain & Products Co., Norwich	*Moosup:* Moosup Grain Co.	8.83	5.55	22.19	20.00	7.75	9.00	50.43	5.25	5.00
6403	*Uncas.* Yantic Grain & Products Co., Norwich	Sampled at factory	11.63	6.10	19.44	20.00	7.25	9.00	51.38	4.20	5.00
	Stock Feeds.										
5823	*Arcady.* Arcady Farms Milling Co. Chicago, Ill.	*So. Manchester:* Smith Bros.	7.58	5.24	11.75	9.00	11.53	12.00	60.45	3.45	3.15
5670	*Pennant.* E. W. Bailey & Co., Montpelier, Vt.	*Mansfield Depot:* M. M. Hanson	8.45	5.07	11.31	9.50	10.20	9.50	58.72	6.25	5.50
4873	*Fortune.* The Coles Co., Middletown	Sampled at factory	15.36	3.34	9.38	9.00	8.92	11.00	58.67	4.33	5.00
6204	*Fortune.* The Coles Co., Middletown	Sampled at factory	8.35	3.40	9.81	9.00	9.80	11.00	64.54	4.10	5.00
5690	*Crosby's.* Crosby Milling Co., Brattleboro, Vt.	*Willimantic:* Windham Grain Store	8.10	4.94	11.13	9.00	12.78	12.00	57.77	5.28	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.* *Stock Feeds—Continued.*										
6258	*Crosby's.* Crosby Milling Co., Brattleboro, Vt.	*Willimantic:* Windham Feed Store	9.48	4.72	9.63	9.00	10.65	12.00	60.69	4.83	4.00
5515	*Davis.* R. G. Davis & Sons, New Haven	*Westville:* Davis Feed Store	9.73	4.63	13.13	10.00	10.33	14.00	59.15	3.03	2.00
5377	*Delaware.* Delaware Mills, Deposit, N. Y.	*Southington:* Southington Lumber Co.	9.28	5.50	9.81	9.00	12.35	12.00	58.26	4.80	3.00
5717	*Devon Sweet Stock Feed.* Devon Coal & Ice Co., Devon	Sampled at factory	8.50	4.79	11.50	8.00	11.52	12.00	59.64	4.05	2.50
5544	*Elmore.* Elmore Milling Co., Oneonta, N. Y.	*Beacon Falls:* Edward Gruber	9.05	3.65	10.06	10.00	8.98	12.00	63.51	4.75	3.00
3643	*Elmore.* Elmore Milling Co., Oneonta, N. Y.	*Beacon Falls:* Edward Gruber	7.98	4.39	10.25	10.00	9.79	12.00	63.16	4.43	3.00
5384	*Eshelman's.* John W. Eshelman & Sons, Lancaster, Pa.	*Simsbury:* Woods Chandler Co.	9.60	3.60	9.31	10.00	10.18	10.00	63.01	4.30	3.00
5383	*Eshelman's Sugared.* John W. Eshelman & Sons, Lancaster, Pa.	*So. Manchester:* Smith Bros.	8.50	5.60	11.56	10.00	13.98	11.00	56.48	3.88	3.25
6238	*Eshelman's Sugared.* John W. Eshelman & Sons, Lancaster, Pa.	*So. Manchester:* Smith Bros.	8.85	5.50	12.06	10.00	14.70	11.00	55.09	3.80	3.25
5736	*Lancaster.* John W. Eshelman & Sons, Lancaster, Pa.	*Stratford:* Farmers' Flour & Grain Co.	9.03	3.64	9.50	10.00	10.60	10.00	63.65	3.58	3.00

	Co., Bangor, Pa.	*Thomaston:* I. Levy	8.88	3.83	9.13	8.00	13.23	14.00	61.34	3.59	3.00
5798	*Algrane New England.* Hecker H-O Co., Buffalo, N. Y.	*Westerly:* C. W. Campbell Co.	8.35	5.96	10.13	9.50	10.18	9.75	61.65	3.73	4.00
6284	*Algrane New England.* Hecker H-O Co., Buffalo, N. Y.	*Westerly:* C. W. Campbell Co.	10.03	5.79	12.19	9.50	9.25	9.75	58.31	4.43	4.00
5842	*Badger.* Chas. A. Krause Milling Co., Milwaukee, Wis.	*Putnam:* Dayville Grain Co.	6.80	5.59	8.19	10.00	16.70	12.00	59.14	3.58	3.00
5843	*Sugared Badger.* A. Krause Milling Co., Milwaukee, Wis.	*Putnam:* Dayville Grain Co.	7.10	5.85	8.75	10.00	16.38	12.00	57.92	4.00	3.00
5502	*Bull.* Maritime Milling Co., Buffalo, N. Y.	*Thomaston:* P. Cunningham	9.35	3.85	11.00	10.00	10.25	10.00	60.66	4.89	3.50
5356	*Red Wing.* Meech & Stoddard, Inc., Middletown	Sampled at factory	8.70	4.81	10.38	9.00	9.38	12.00	62.30	4.43	3.00
5346	*Fidelity.* Nowak Milling Corp., Hammond, Ind.	*Higganum:* F. A. Petrofsky	9.50	4.00	8.31	8.00	10.33	12.00	64.63	3.23	3.00
5172	*Park & Pollard.* The Park & Pollard Co., Buffalo, N. Y.	*West Cheshire:* Cheshire Grain & Coal Co.	8.78	5.16	10.19	8.00	10.25	12.00	60.67	4.95	2.50
5252	*Pratt's Supreme.* Pratt Food Co., Philadelphia, Pa.	*New Britain:* S. P. Strople	9.95	4.22	9.56	9.00	9.48	12.00	62.94	3.85	3.00
4799	*Schumacher.* Quaker Oats Co., Chicago, Ill.	*Danbury:* F. C. Benjamin	12.88	6.10	10.75	10.00	10.93	12.00	56.00	3.34	3.25
5483	*Schumacher.* Quaker Oats Co., Chicago, Ill.	*Ansonia:* Ansonia Flour & Feed Co.	8.12	5.49	10.13	10.00	12.93	12.00	59.10	4.23	3.25
6017	*Schumacher.* Quaker Oats Co., Chicago, Ill.	*Ansonia:* Ansonia Flour & Feed Co.	7.53	5.66	10.94	10.00	11.60	12.00	59.67	4.60	3.25
5205	*Sugared Schumacher.* Quaker Oats Co., Chicago, Ill.	*Thompsonville:* Geo. S. Phelps & Co.	8.40	4.73	9.81	10.00	11.48	12.00	61.38	4.20	3.25
5651	*White Star.* Quaker Oats Co., Chicago, Ill.	*Long Hill:* Long Hill Feed Store	7.64	5.87	8.63	9.00	13.03	14.00	60.73	4.10	3.00
5747	*Purina Steer Fatena.* Ralston Purina Mills, St. Louis, Mo.	*New Canaan:* Clapboard Hill Feed Co.	11.83	8.89	13.88	12.00	8.73	10.00	52.24	4.43	2.50
5682	*77 Stock Feed.* Rosenbaum Bros., Chicago, Ill.	*Stafford Springs:* Dennis Grain Mill	7.88	8.66	9.19	9.00	14.60	15.00	56.34	3.33	3.50
5860	*Homespun.* Paty Schwartz Co., New London	Sampled at factory	8.40	5.09	9.75	9.00	12.90	12.00	59.53	4.33	4.00
5584	*Charlestock.* St. Albans Grain Co., St. Albans, Vt.	*Kent:* Kent Grain & Coal Co.	7.88	4.19	9.06	9.00	13.34	14.00	60.18	5.35	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.* *Stock Feeds—Concluded.*										
5663	*King.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	8.20	4.34	10.38	9.00	10.10	12.00	60.93	6.05	5.00
5215	*Wirthmore.* St. Albans Grain Co., St. Albans, Vt.	*Meriden:* H. Grulich	8.60	3.91	10.31	9.00	8.70	9.50	62.40	6.08	4.00
5752	*Syragold.* Syracuse Milling Co., Syracuse, N. Y.	*Colchester:* David Shea	9.25	3.92	10.13	9.00	10.18	12.00	62.39	4.13	3.00
6573	*E-Gee.* Tioga-Empire Feed Mill, Waverly, N. Y.	*Hawleyville:* W. A. Honan	8.60	4.84	12.50	10.00	9.65	12.00	59.08	5.33	3.00
5743	*Uncas.* Yantic Grain & Products Co., Norwich	*Norwich:* Greenville Grain Co.	7.48	5.34	11.13	9.00	13.10	12.00	57.95	5.00	4.00
	Calf Feeds, etc.										
5509	*Blatchford.* Blatchford Calf Meal Co., Waukegan, Ill.	*Middletown:* Meech & Stoddard, Inc.	10.50	7.92	24.19	24.00	5.35	6.75	47.44	4.60	5.00
6011	*Blatchford.* Blatchford Calf Meal Co., Waukegan, Ill.	*Middletown:* Meech & Stoddard, Inc.	10.20	7.37	24.13	24.00	5.55	6.75	47.95	4.80	5.00
6317	*Elmore.* Elmore Milling Co., Oneonta, N. Y.	*Hazardville:* Amos D. Bridges Sons	11.03	4.75	23.44	24.00	3.70	4.00	52.75	4.33	4.00
5546	*Stevens Milkade.* Park & Pollard Co., Buffalo, N. Y.	*Waterbury:* Spencer Grain Co.	7.58	9.13	22.44	20.00	4.93	7.50	47.24	8.68	8.00
6522	*Schumacher.* Quaker Oats Co., Chicago, Ill.	*Rockville:* Rockville Milling Co.	7.88	7.18	20.56	18.00	2.85	4.00	53.73	7.80	8.00

5303	*Purina Pig Chow Feed.* Ralston Purina Co., St. Louis, Mo.	*Manchester:* Manchester Grain Co.	10.73	4.34	28.25	27.00	3.30	4.50	49.30	4.08	3.20
6001	*Wirthmore Pig Feed.* St. Albans Grain Co., St. Albans, Vt.		11.15	9.80	24.75	20.00	5.75	7.00	45.17	3.38	3.20
		Chester: Leet Bros.	9.53	6.08	18.19	17.00	5.50	9.00	55.05	5.65	4.00
5587	*Tioga Calf Food.* Tioga Mill & Elevator Co., Waverly, N. Y.	*Hawleyville:* W. A. Honan	8.38	6.50	23.50	21.00	4.68	7.00	52.01	4.93	4.00
	Poultry Feeds.										
4875	*Amco Egg Mash.* American Milling Co., Peoria, Ill.	*Middletown:* Chas. Dragoo	13.32	8.44	20.63	20.00	5.95	7.00	47.04	4.62	3.50
4879	*Amco Egg Mash with Dried Buttermilk.* American Milling Co., Peoria, Ill.	*Middletown:* Chas. Dragoo	10.61	8.23	20.63	20.00	5.95	7.00	50.21	4.37	4.50
5883	*Amco Egg Mash with Dried Buttermilk.* American Milling Co., Peoria, Ill.	*Stamford:* Clapboard Hill Feed Co.	9.15	7.02	19.13	19.00	6.38	7.00	53.07	5.25	4.00
4878	*Amco Chick Grains.* American Milling Co., Peoria, Ill.	*Middletown:* Chas. Dragoo	12.00	1.43	11.38	10.00	1.28	4.00	71.11	2.80	3.00
4874	*Amco Scratch Grains.* American Milling Co., Peoria, Ill.	*Middletown:* Chas. Dragoo	20.84	1.59	10.88	10.00	2.51	4.50	61.06	3.12	3.00
4880	*Amco Starting and Growing Mash with Buttermilk.* American Milling Co., Peoria, Ill.	*Middletown:* Chas. Dragoo	10.49	9.00	19.31	18.00	5.41	4.00	50.83	4.96	6.00
5839	*Wonder Laying Mash.* Arcady Farms Milling Co., Chicago, Ill.	*So. Manchester:* Smith Bros.	7.58	12.41	21.06	20.00	6.53	8.00	47.04	5.38	4.50
5520	*Auburn Scratch Feed.* Beacon Milling Co., Cayuga, N. Y.	*New Milford:* W. L. Richmond & Son	12.46	1.34	9.88	9.00	2.08	5.00	71.26	2.98	3.00
6574	*Beacon Chick Feed.* Beacon Milling Co., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	12.50	1.58	10.50	11.00	1.43	3.00	70.09	3.90	2.50
5511	*Beacon Developer Feed.* Beacon Milling Co., Cayuga, N. Y.	*Derby:* Peterson-Hendee Co.	11.88	1.46	10.56	10.00	1.19	5.00	70.84	4.07	2.50
5468	*Beacon Egg Mash with Buttermilk.* Beacon Milling Co., Cayuga, N. Y.	*Derby:* Peterson-Hendee Co.	9.03	9.87	22.13	22.00	5.10	7.00	48.74	5.13	4.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25)		Fiber		Nitrogen-free extract (starch, gum, etc.)	Fat	
					Found	Guaranteed, not less than	Found	Guaranteed, not more than		Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
4806	*Beacon Growing Mash.* Beacon Milling Co., Cayuga, N. Y. ..	*New Milford:* W. L. Richmond & Son	10.63	9.51	17.56	17.00	5.77	7.00	51.76	4.77	4.50
6527	*Beacon Growing Mash.* Beacon Milling Co., Cayuga, N. Y. ..	*Derby:* Peterson-Hendee Co. ..	10.68	9.87	16.94	17.00	5.40	7.00	52.13	4.98	4.50
4869	*Beacon Scratch Grains.* Beacon Milling Co., Cayuga, N. Y. ..	*Derby:* Peterson-Hendee Co. ..	15.11	1.51	9.81	9.00	2.12	5.00	68.72	2.73	3.00
5831	*Beacon Scratch Grains.* Beacon Milling Co., Cayuga, N. Y. ..	*Danbury:* C. S. Barnum & Son	12.18	1.38	9.69	9.00	2.13	5.00	71.89	2.73	3.00
6249	*Beacon Scratch Grains.* Beacon Milling Co., Cayuga, N. Y. ..	*Danbury:* C. S. Barnum & Son	13.85	1.46	9.31	9.00	2.50	5.00	70.08	2.80	3.00
4805	*Beacon Starting Mash.* Beacon Milling Co., Cayuga, N. Y. ..	*New Milford:* W. L. Richmond & Son	14.50	7.92	16.69	14.00	4.71	6.00	51.70	4.48	4.50
6528	*Beacon Starting Mash.* Beacon Milling Co., Cayuga, N. Y. ..	*Derby:* Peterson-Hendee Co. ...	10.78	8.14	15.31	14.00	4.30	6.00	57.57	3.90	4.50
6593	*Beacon Laying Mash.* Beacon Milling Co., Cayuga, N. Y. ..	*Danbury:* C. S. Barnum & Son	10.45	9.11	21.25	20.00	6.18	8.00	47.83	5.18	5.00
5517	*Cayuga Laying Mash with Buttermilk.* Beacon Milling Co., Cayuga, N. Y.	*Southbury:* H. R. Stone	9.30	8.51	10.63	20.00	5.88	7.00	51.05	5.63	4.00

	Milling Co., Cayuga, N. Y. ..	Son	13.45	1.45	10.00	10.00	1.21	5.00	70.54	3.35	2.50
4808	*Chariot Developer Feed.* Beacon Milling Co., Cayuga, N. Y. ...	*New Milford:* W. L. Richmond & Son	12.85	1.23	10.44	10.00	1.72	5.00	70.70	3.06	2.50
5158	*Beers' Laying Mash.* Ira W. Beers, Hamden	Sampled at factory	10.00	8.46	21.69	22.00	6.13	7.00	48.14	5.58	6.00
5157	*Beers' Scratch Feed.* Ira W. Beers, Hamden	Sampled at factory	12.48	1.68	10.75	9.00	3.33	4.00	68.56	3.20	4.00
5208	*Bidwell Scratch Feed.* The Park & Pollard Co., Buffalo, N. Y.	*Plainville:* F. B. Newton	12.00	1.51	10.31	10.00	2.38	5.00	70.62	3.18	1.50
3632	*Blatchford's Chick Mash with Buttermilk.* Blatchford Calf Meal Co., Waukegan, Ill.	*Middletown:* Meech & Stoddard, Inc.	9.45	12.64	18.50	18.00	4.73	6.50	50.54	4.14	4.00
5755	*Egg-O-Dry Mash.* C. W. Campbell Co., Westerly, R. I.	Sampled at factory	8.03	9.40	21.44	18.00	7.50	12.00	47.80	5.83	2.00
5753	*Egg-O-Scratch Feed.* C. W. Campbell Co., Westerly, R. I.	Sampled at factory	12.75	1.37	10.19	10.00	2.13	5.00	71.18	2.38	2.00
6257	*Albert Angell Jr.'s Chick Starter.* Coles Co., Middletown	Sampled at factory	10.15	8.55	18.38	15.00	4.25	5.00	53.62	5.05	5.00
6526	*Albert Angell Jr.'s Coarse Chick Scratch.* Coles Co., Middletown	Sampled at factory	14.18	1.31	9.81	10.00	1.95	3.00	70.05	2.70	5.00
6525	*Albert Angell Jr.'s Egg Mash.* Coles Co., Middletown	Sampled at factory	9.20	11.38	21.13	20.00	5.15	8.00	47.94	5.20	4.00
6261	*Albert Angell Jr.'s Fine Chick Scratch.* Coles Co., Middletown	Sampled at factory	10.30	1.59	12.00	10.00	1.20	3.00	70.61	4.30	5.00
6414	*Albert Angell Jr.'s Fine Chick Scratch.* Coles Co., Middletown	Sampled at factory	12.33	1.52	11.25	10.00	1.45	3.00	69.72	3.73	5.00
6202	*Albert Angell Jr.'s Growing Mash.* Coles Co., Middletown	Sampled at factory	9.00	6.39	17.56	15.00	5.07	6.00	56.85	5.13	5.00
6597	*Albert Angell Jr.'s Scratch Feed.* Coles Co., Middletown	Sampled at factory	14.58	1.70	10.25	10.00	4.00	3.00	65.47	4.00	2.75
4812	*Fortune Egg Mash.* Coles Co., Middletown	Sampled at factory	8.91	5.45	24.00	17.00	8.98	9.00	46.16	6.50	3.50
6206	*Fortune Egg Mash with Dried Buttermilk.* Coles Co., Middletown	*Colchester:* David Shea	8.95	9.06	19.50	17.00	5.30	9.00	50.84	6.35	3.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Fiber: Found	Fiber: Guaranteed, not less than	Protein (N x 6.25): Found	Protein: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
813	*Fortune Scratch.* Coles Co., Middletown	Sampled at factory	14.41	1.68	10.63	10.00	3.99	5.00	65.76	3.53	2.50
203	*Fortune Scratch.* Coles Co., Middletown	Sampled at factory	12.48	1.52	10.19	10.00	2.63	5.00	70.38	2.80	2.50
595	*C. A. Blue Seal Mash.* C. A. Cowles, Plantsville	Sampled at factory	8.63	8.36	20.50	18.00	4.98	6.00	52.11	5.42	4.00
596	*Cowles Scratch Feed.* C. A. Cowles, Plantsville	*Meriden:* West End Feed & Supply Co.	11.88	1.35	9.88	10.00	2.02	5.00	72.17	2.70	1.50
365	*Conkey's Buttermilk, Grain and Bone Starting Feed.* G. E. Conkey Co., Cleveland, Ohio	*Middletown:* Meech & Stoddard, Inc.	10.88	5.13	14.25	14.00	3.55	4.00	61.11	5.08	3.00
595	*Conkey's Buttermilk Meat, Grain and Bone Laying Mash.* G. E. Conkey Co., Cleveland, Ohio	*So. Norwalk:* Roodner Feed Co.	10.33	12.66	23.56	20.00	4.60	6.00	43.19	5.66	5.00
630	*Conkey's Growing Grains.* G. E. Conkey Co., Cleveland, Ohio	*Ridgefield:* Ridgefield Lumber Co.	10.60	1.68	12.44	13.00	1.50	2.00	69.28	4.50	2.50
479	*Crosby's Egg Mash Feed.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savinsky	9.90	10.36	22.06	20.00	4.70	7.00	47.29	5.69	4.00
476	*Crosby's Scratch Feed.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savinsky	12.48	1.45	9.75	11.00	2.48	5.00	70.60	[illegible]	[illegible]

	[illegible] Milling Co., Brattleboro, Vt...	*So. Norwalk:* Roodner Feed Co.	17.08	1.47	9.75	11.00	3.14	5.00	66.53	2.03	3.00
5482	*Davis Mash Feed.* R. G. Davis & Sons, New Haven	*Ansonia:* Ansonia Flour & Feed Co.	9.82	6.55	18.44	18.00	5.80	7.00	53.94	5.45	5.00
5480	*Davis Scratch Feed.* R. G. Davis & Sons, New Haven	*Ansonia:* Ansonia Feed Co.	13.21	1.52	9.81	10.00	2.26	5.00	70.12	3.08	2.00
5382	*Delaware Scratch Grains.* Delaware Mills, Deposit, N. Y.....	*Meriden:* Standard Grain & Coal Co.	13.95	1.47	9.50	10.00	2.63	5.00	69.50	2.95	2.50
5866	*Indian Laying Mash.* Delaware Mills Deposit, N. Y.	*Bloomfield:* Bloomfield Farmers' Exchange	9.38	7.14	18.13	18.00	5.73	7.00	53.27	6.35	4.00
6529	*Indian Scratch Grains.* Delaware Mills, Deposit, N. Y.	*Stepney:* M. Nusbaum	14.28	1.46	9.81	10.00	2.65	5.00	68.77	3.03	2.50
5718	*Devon Laying Mash.* Devon Coal & Ice Co., Devon	Sampled at factory	8.93	8.35	21.50	18.00	5.45	7.00	50.09	5.68	5.00
5659	*Eastern States Egg Mash.* Eastern States Farmers' Exchange, Springfield, Mass.	*Farmington:* Albert Thompson..	9.67	6.87	19.56	18.50	6.03	8.00	51.92	5.95	3.50
5635	*Eastern States Egg Mash Buttermilk.* Eastern States Farmers' Exchange, Springfield, Mass.	*Seymour:* John Swan	8.85	5.85	18.38	17.00	6.07	7.50	54.88	5.97	5.00
5494	*Eastern States Scratch Grains.* Eastern States Farmers' Exchange, Springfield, Mass.	*Seymour:* John Swan	13.09	1.50	10.44	10.00	2.25	4.50	69.62	3.10	3.00
3644	*Elmore Egg Mash.* Elmore Milling Co., Oneonta, N. Y.	*Beacon Falls:* Edward Gruber..	10.20	7.21	20.38	18.00	6.28	8.00	50.60	5.33	4.00
5260	*Elmore Egg Mash.* Elmore Milling Co., Oneonta, N. Y.	*Hazardville:* Amos D. Bridges Sons	9.40	9.27	19.50	18.00	4.45	8.00	51.40	5.98	4.00
4797	*Elmore Growing Mash.* Elmore Milling Co., Oneonta, N. Y. ..	*Colchester:* P. Cutler, Inc.	14.30	9.05	17.44	17.00	5.58	8.00	49.63	4.00	4.00
6279	*Elmore Storrs Formula Laying Mash.* Elmore Milling Co., Oneonta, N. Y.	*Willimantic:* Windham Grain Store	11.43	9.33	19.25	20.00	6.05	7.00	47.99	5.95	4.00
6286	*Elmore Scratch Feed.* Elmore Milling Co., Oneonta, N. Y...	*Higganum:* F. A. Petrofsky ...	13.43	1.62	10.44	10.00	2.60	7.00	68.81	3.10	3.50
6600	*Elmore Scratch Feed.* Elmore Milling Co., Oneonta, N. Y. ..	*Higganum:* F. A. Petrofsky ...	14.10	1.30	10.19	10.00	2.69	7.00	69.04	2.68	3.50
5316	*Emco Scratch Feed.* Elmore Milling Co., Oneonto, N. Y. ..	*Hazardville:* Amos D. Bridges Sons	12.63	1.52	10.50	10.00	3.05	7.00	69.10	3.20	3.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1920—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (*starch, gum, etc.*)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
6009	*Emco Scratch Feed.* Elmore Milling Co., Oneonta, N. Y.	*Hazardville:* Amos D. Bridges Sons	13.78	1.51	10.31	10.00	3.03	7.00	68.18	3.19	3.50
6277	*Eshelman's Baby Chick Starter.* John W. Eshelman & Son, Lancaster, Pa.	*Wallingford:* A. E. Hall	8.20	5.01	15.63	10.00	3.30	5.00	62.66	5.20	4.00
6276	*Eshelman's Chick Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Wallingford:* A. E. Hall	12.68	1.75	10.88	10.00	1.45	3.00	68.61	4.63	3.00
5582	*Eshelman's Growing Mash.* John W. Eshelman & Son, Lancaster, Pa.	*Canaan:* Ives & Pierce	9.33	6.23	19.00	16.00	5.24	8.00	54.70	5.50	4.00
5152	*Eshelman's Laying Mash.* John W. Eshelman & Son, Lancaster, Pa.	*Highwood:* T. C. Hadden & Co.	9.75	7.09	21.38	20.00	5.15	7.00	50.75	5.88	5.00
5386	*Eshelman's Scratch Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Bristol:* Bristol Grain & Supply Co.	13.23	1.46	10.31	10.00	2.45	4.00	69.55	3.00	3.00
5296	*Imperial Scratch Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Manchester:* Little & McKinney	13.05	1.30	9.44	9.00	2.15	4.00	70.88	3.18	3.00

5197	*Pennsy Scratch Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Highwood:* T. C. Hadden & Co.	12.53	1.32	9.63	9.00	2.00	4.00	71.82	2.70	3.00
5746	*Pennsy Scratch Feed.* John W. Eshelman & Son, Lancaster, Pa.	*Norwalk:* Frank Libner & Son	12.60	1.31	9.88	9.00	2.05	4.00	71.51	2.65	3.00
5267	*Flory's Superior Egg Mash.* Flory Milling Co., Bangor, Pa.	*Bloomfield:* Bloomfield Farmers' Exchange	8.53	10.54	19.94	20.00	7.83	8.00	47.96	5.20	5.50
5868	*Flory's Superior Egg Mash.* Flory Milling Co., Bangor, Pa.	*Bloomfield:* Bloomfield Farmers' Exchange	9.50	9.79	19.25	20.00	7.55	8.00	49.08	4.83	5.50
5867	*Flory's Superior Scratch Grains.* Flory Milling Co., Bangor, Pa.	*Bloomfield:* Bloomfield Farmers' Exchange	13.43	1.44	10.00	9.00	2.23	4.00	70.20	2.70	2.50
5505	*Golden Egg Scratch Feed.* Flory Milling Co., Bangor, Pa.	*Thomaston:* I. Levy	13.13	1.56	10.25	9.00	2.35	5.00	69.59	3.12	2.50
5514	*Golden Egg Laying Mash.* Flory Milling Co., Bangor, Pa.	*Thomaston:* I. Levy	9.68	7.16	18.88	18.00	6.24	10.00	52.84	5.20	4.00
5504	*Sunray Scratch Feed.* Flory Milling Co., Bangor, Pa.	*Thomaston:* I. Levy	12.60	1.58	10.13	9.00	2.38	5.00	70.28	3.03	2.50
6229	*R Own Laying Mash.* A. W. Forbes, East Haven	Sampled at factory	10.78	9.80	22.50	20.00	4.73	6.00	47.39	4.80	5.00
6006	*R Own Scratch Feed.* A. W. Forbes, East Haven	Sampled at factory	10.78	1.73	10.75	10.00	3.58	5.00	69.43	3.73	3.00
4795	*Grandin's Intermediate Chick Feed.* D. H. Grandin Milling Co., Jamestown, N. Y.	*Willimantic:* Willimantic Grain Co.	14.65	1.34	11.00	10.00	1.35	5.00	69.07	2.59	2.50
5196	*Cackle Scratch Feed, No Grit.* Hales & Hunter Co., Chicago, Ill.	*Highwood:* T. C. Hadden & Co.	12.35	1.42	10.19	10.00	1.98	5.00	70.91	3.15	2.50
5194	*Red Comb Egg Mash with Dried Buttermilk.* Hales & Hunter Co., Chicago, Ill.	*Highwood:* T. C. Hadden & Co.	9.33	7.81	19.31	20.00	5.20	7.00	53.27	5.08	4.50
5195	*Red Comb Scratch Feed, No Grit.* Hales & Hunter Co., Chicago, Ill.	*Highwood:* T. C. Hadden & Co.	12.00	1.58	10.69	10.00	2.55	5.00	69.73	3.45	2.50
4802	*Algrane Steam-Cooked Chick Feed.* Hecker H-O Co., Buffalo N. Y.	*So. Norwalk:* Roodner Feed Co.	12.80	1.31	11.00	12.00	1.09	4.00	71.57	2.23	3.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, *not more than*	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, *not less than*
			Pounds per Hundred								
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
6310	*"Hudson's" Developing Mash.* L. W. Hudson, Windsor	Sampled at factory	7.73	8.03	18.88	17.00	5.15	5.40	54.46	5.75	6.00
5630	*"Hudson's" Laying Mash.* L. W. Hudson, Windsor	Sampled at factory	8.30	11.92	20.06	19.00	6.75	5.00	47.12	5.85	6.00
5656	*Ingersoll's Special Egg Mash.* Z. C. Ingersoll, Stratford	Sampled at factory	8.72	9.91	18.88	18.00	7.20	8.44	48.96	6.33	6.45
5248	*Dry Mash.* I. F. Labieniec, Kensington	Sampled at factory	9.88	8.72	19.75	19.00	7.20	9.00	48.77	5.68	5.00
4800	*Larro Chick Grains.* Larrowe Milling Co., Detroit, Mich. ...	*Danbury:* H. E. Meeker	13.94	1.25	11.75	10.00	2.46	3.50	67.73	2.87	3.00
6568	*Larro Chick Grains.* Larrowe Milling Co., Detroit, Mich. ...	*Winsted:* E. Manchester & Sons	11.65	1.35	10.69	10.00	1.40	3.50	71.58	3.33	3.00
4798	*Larro Chick Starter.* Larrowe Milling Co., Detroit, Mich. ...	*Collinsville:* Lawton-Miner Co.,	14.11	6.23	16.13	14.00	4.34	6.50	54.45	4.74	4.50
6567	*Larro Chick Starter.* Larrowe Milling Co., Detroit, Mich. ...	*Winsted:* E. Manchester & Sons	11.10	6.16	15.06	14.00	4.40	6.50	58.08	5.20	4.50
5162	*Larro Egg Mash.* Larrowe Milling Co., Detroit, Mich.	*Plainville:* W. S. Eaton	8.78	11.15	20.19	19.00	5.78	8.00	48.90	5.20	5.00
6570	*Larro Growing Mash.* Larrowe	*New Milford:* Geo. E. Ackley &	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Leggett & Co., Stamford	Co.	11.75	1.38	9.94	9.00	2.00	4.00	72.25	2.08	3.00
5826	*Premier Growing Feed.* Francis H. Leggett & Co., Stamford ..	*Stamford:* Clapboard Hill Feed Co.	8.18	7.60	16.94	15.00	5.38	4.50	56.30	5.60	4.50
5827	*Premier Scratch Feed.* Francis H. Leggett & Co., Stamford ..	*Stamford:* Clapboard Hill Feed Co.	11.53	1.48	10.25	9.00	2.00	4.00	71.66	3.08	3.00
5368	*Homestead Dry Mash.* C. W. Lines Co., New Britain	Sampled at factory	9.80	9.90	20.31	18.00	6.65	7.00	47.36	5.98	4.00
5371	*Homestead Scratch Feed.* C. W. Lines Co., New Britain	Sampled at factory	13.35	1.35	10.25	9.00	2.68	5.00	69.27	3.10	2.50
5369	*Millpride Fancy Scratch Feed.* C. W. Lines Co., New Britain	Sampled at factory	13.00	1.60	10.75	10.00	2.60	5.00	68.72	3.33	3.00
6013	*MillPride Milk Mash for Laying Hens.* C. W. Lines Co., New Britain	Sampled at factory	7.93	11.36	19.81	18.00	6.60	7.50	49.12	5.18	5.00
4872	*Uniform Fancy Scratch Feed.* C. W. Lines Co., New Britain	Sampled at factory	14.20	1.44	10.00	10.00	1.59	5.00	69.64	3.13	3.00
6566	*Common Sense Growing Mash.* Litchfield County Co-op. Assoc., Torrington	Sampled at factory	11.68	7.30	16.36	15.00	5.38	8.00	55.37	3.89	4.00
6565	*Common Sense Laying Mash.* Litchfield County Co-op. Assoc. Torrington	Sampled at factory	11.73	9.30	15.81	15.00	5.50	8.00	53.36	4.30	4.00
5600	*Square Deal Mash.* Long Hill Feed Store, Long Hill	Sampled at factory	8.83	9.90	20.13	20.00	6.70	7.00	48.84	5.60	5.00
5581	*Buttermilk Growing Mash.* E. Manchester & Sons, Winsted..	Sampled at factory	8.33	7.26	19.81	20.00	4.80	6.00	54.40	5.40	4.00
5575	*Red Star Scratch Feed.* E. Manchester & Sons, Winsted	Sampled at factory	11.48	1.58	10.38	12.00	2.95	5.00	70.88	2.73	3.00
6275	*Red Star Scratch Feed.* E. Manchester & Sons, Winsted	Sampled at factory	13.50	1.52	10.19	12.00	3.03	5.00	69.04	2.72	2.00
5573	*Storrs Egg Mash.* E. Manchester & Sons, Winsted	Sampled at factory	9.18	10.16	18.69	18.00	6.78	8.00	49.14	6.05	4.00
6569	*Bull Brand Chick Feed.* Maritime Milling Co., Buffalo, N. Y.	*New Milford:* Geo. E. Ackley & Co.	12.80	1.20	10.94	11.00	1.80	4.00	71.08	2.18	2.50
5571	*Bull Brand Chick Starter (with Dried Buttermilk).* Maritime Milling Co., Buffalo, N. Y. ..	*Riverton:* L. A. Coe	10.68	5.12	16.69	12.00	4.29	4.00	57.97	5.25	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
					Protein (N x 6.25)		Fiber			Fat	
			Water	Ash	Found	Guaranteed, not less than	Found	Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.* *Poultry Feeds—Continued.*										
5572	*Bull Brand Laying Mash (with Dried Buttermilk).* Maritime Milling Co., Buffalo, N. Y. ..	*Riverton:* L. A. Coe	9.70	10.31	22.06	20.00	7.13	8.00	44.85	5.95	5.00
5724	*Bull Brand Scratch Feed.* Maritime Milling Co., Buffalo, N. Y.	*Stamford:* Clapboard Hill Feed Co.	12.50	1.38	10.50	11.00	1.90	4.00	71.22	2.50	2.50
5234	*Red E Mixt Scratch Feed.* Maritime Milling Co., Buffalo, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	12.23	1.41	9.94	10.00	2.55	4.00	70.82	3.05	2.50
6524	*Red Wing Special Buttermilk Chick Starter.* Meech & Stoddard, Inc., Middletown	Sampled at factory	11.18	9.17	17.56	13.00	5.18	5.00	52.03	4.88	4.00
5353	*Red Wing Special Buttermilk Growing Feed.* Meech & Stoddard, Inc., Middletown	*Middlefield:* Middlefield Grain & Coal Co.	9.23	13.83	18.88	17.00	5.85	8.00	46.93	5.28	5.50
5830	*Red Wing Special Buttermilk Laying Mash.* Meech & Stoddard, Inc., Middletown	*Meriden:* Meriden Grain & Coal Co.	8.05	7.79	20.88	17.00	6.00	7.00	50.68	6.60	5.50
6523	*Red Wing Special Chick Feed.* Meech & Stoddard, Inc., Middletown	Sampled at factory	13.23	1.66	11.19	10.00	1.80	5.00	68.32	3.80	3.00
5352	*Red Wing Special Intermediate*										

5649	*Moon's Laying Mash with Dried Buttermilk.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Norfolk:* Aug. P. Curtis	9.36	9.73	19.44	20.00	6.43	9.00	49.56	5.48	4.00
5603	*C-B Mash.* Moran-Patton Co., New Haven	Sampled at factory	9.89	8.07	20.19	18.00	7.04	7.00	48.79	6.02	4.00
5336	*Old Mill Buttermilk Laying Mash.* Fred C. Morse, Guilford	Sampled at factory	9.60	7.98	21.19	20.00	6.83	7.00	48.47	5.93	5.00
5334	*Old Mill Mash Feed.* Fred C. Morse, Guilford	Sampled at factory	9.25	8.33	22.00	20.00	6.69	7.00	47.83	5.90	5.00
5338	*Old Mill Scratch Feed.* Fred C. Morse, Guilford	Sampled at factory	12.65	1.45	10.06	10.00	2.49	4.00	70.65	2.70	3.00
6227	*Old Mill Scratch Feed.* Fred C. Morse, Guilford	Sampled at factory	15.50	1.51	9.50	10.00	2.53	4.00	68.01	2.95	3.00
3642	*Domino Baby Chick Starter with Buttermilk.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	9.15	7.92	20.88	20.00	5.28	6.00	51.39	5.38	4.50
6599	*Domino Baby Chick Starter with Buttermilk.* Nowak Milling Corp., Hammond, Ind.	*Higganum:* F. A. Petrofsky ...	11.05	7.42	20.81	20.00	5.60	6.00	49.79	5.33	4.50
3641	*Domino Chick Feed.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	11.65	1.52	12.13	11.00	1.98	5.00	69.79	2.93	2.00
6601	*Domino Chick Feed.* Nowak Milling Corp., Hammond, Ind.	*Higganum:* F. A. Petrofsky ...	13.88	1.32	10.00	11.00	1.91	5.00	70.46	2.43	2.00
5391	*Domino Developing Feed.* Nowak Milling Corp., Hammond, Ind.	*Manchester:* I. P. Campbell	11.90	1.37	11.13	10.00	2.10	5.00	71.05	2.45	2.50
5556	*Domino Growing Mash with Buttermilk.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	9.20	6.72	20.31	18.00	4.95	7.00	53.42	5.40	4.50
5557	*Domino Laying Mash with Buttermilk.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	9.05	8.67	20.25	18.00	4.98	7.00	52.22	4.83	3.50
6254	*Domino Pigeon Feed.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	10.90	1.79	12.50	10.00	2.60	5.00	70.21	2.00	2.50
5554	*Domino Scratch Feed.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	13.17	1.56	10.56	10.00	2.30	5.00	69.91	2.50	2.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
					Protein (N x 6.25)		Fiber			Fat	
			Water	Ash	Found	Guaranteed, not less than	Found	Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
5395	*Fidelity Scratch Feed.* Nowak Milling Corp., Hammond, Ind.	*Manchester:* I. P. Campbell	12.33	1.50	10.56	10.00	2.53	5.00	69.83	3.25	2.50
6253	*Marathon Chick Feed.* Nowak Milling Corp., Hammond, Ind.	*Waterville:* Wooster's Feed Store	11.80	1.56	11.44	11.00	1.89	5.00	70.03	3.28	2.00
5348	*Marathon Laying Mash with Buttermilk.* Nowak Milling Corp., Hammond, Ind.	*Higganum:* F. A. Petrofsky	8.88	6.74	20.56	20.00	6.85	9.00	51.89	5.08	4.50
5394	*Marathon Scratch Feed.* Nowak Milling Corp., Hammond, Ind.	*Manchester:* I. P. Campbell	11.78	1.51	10.19	10.00	3.35	5.00	70.02	3.15	2.50
5327	*Osborn Mash.* S. V. Osborn Est., Branford	Sampled at factory	10.83	3.43	14.63	12.00	6.35	8.00	61.23	3.53	3.00
5326	*Osborn Scratch.* S. V. Osborn Est., Branford	Sampled at factory	12.73	1.59	10.38	10.00	2.08	5.00	70.02	3.20	2.00
6271	*Baby Buster Chick Feed.* The Park & Pollard Co., Buffalo, N. Y.	*Putnam:* Bosworth Bros.	13.85	1.67	12.50	10.00	1.60	5.00	67.48	2.90	2.00
5723	*Bidwell Dry Mash.* The Park & Pollard Co., Buffalo, N. Y. ..	*Fairfield:* Samp Mortar Mill ...	9.60	11.53	21.25	18.00	5.49	12.00	47.68	4.45	1.50
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61.06	3.63	3.00

6319	*Bonnie Booster.* The Park & Pollard Co., Buffalo, N. Y. ..	*Hazardville:* A. D. Bridges Sons	12.83	5.00	14.25	12.00	3.70	3.00	61.29	2.93	3.00
5397	*Growing Feed.* The Park & Pollard Co., Buffalo, N. Y. ..	*East Hartford:* Meech Grain Co.	10.73	7.25	15.63	14.00	6.03	8.00	55.83	4.53	1.50
5262	*Intermediate Chick Feed.* The Park & Pollard Co., Buffalo, N. Y.	*Hazardville:* A. D. Bridges Sons	11.45	1.31	10.63	10.00	1.95	5.00	72.01	2.65	1.50
5403	*Lay or Bust Dry Mash.* The Park & Pollard Co., Buffalo, N. Y.	*Torrington:* F. L. Wadhams ...	9.60	10.04	17.50	18.00	5.39	10.00	53.47	4.00	1.50
5413	*Leghorn Special Dry Mash.* The Park & Pollard Co., Buffalo, N. Y.	*East Hartford:* Meech Grain Co.	9.10	11.06	22.13	21.00	6.60	10.00	46.18	4.93	1.50
5399	*Pigeon Feed.* The Park & Pollard Co., Buffalo, N. Y.	*East Hartford:* Meech Grain Co.	12.65	1.69	13.31	10.00	2.40	5.00	67.60	2.35	1.50
6407	*Red Ribbon Chick Feed.* The Park & Pollard Co., Buffalo, N. Y.	*West Cheshire:* Cheshire Grain & Coal Co.	14.30	1.46	10.69	10.00	1.63	5.00	69.14	2.78	2.00
5217	*Red Ribbon Scratch Feed.* The Park & Pollard Co., Buffalo, N. Y.	*New Britain:* S. P. Strople	12.15	1.49	10.25	10.00	2.58	5.00	70.15	3.38	1.50
5471	*P-H Mash.* Peterson-Hendee Co., Derby	Sampled at factory	10.70	5.31	17.94	17.00	4.09	7.00	57.83	4.13	4.00
5470	*P-H Scratch Feed.* Peterson-Hendee Co., Derby	Sampled at factory	13.15	1.73	10.56	10.00	2.40	5.00	68.56	3.60	2.00
5634	*Purgrain Breeding Feed.* Philadelphia Seed Co., Philadelphia, Pa.	*Shelton:* Shelton Feed Co.	11.08	1.95	15.00	15.00	3.83	3.50	63.49	4.65	3.00
5804	*Purgrain Pigeon Feed No. 4.* Philadelphia Seed Co., Philadelphia, Pa.	*New Haven:* R. G. Davis & Sons	9.78	1.67	12.50	12.50	2.20	4.00	70.45	3.40	3.00
5537	*Platco Laying Mash.* Frank S. Platt Co., New Haven	Sampled at factory	9.03	11.13	24.75	20.00	6.28	7.00	43.08	5.73	5.50
5536	*Platco Perfection Grain Mixture.* Frank S. Platt Co., New Haven	Sampled at factory	13.23	1.39	10.19	10.50	2.24	4.50	70.25	2.70	3.00
6005	*Platco Perfection Grain Mixture.* Frank S. Platt Co., New Haven	Sampled at factory	12.63	1.38	9.88	10.50	2.40	4.50	70.21	3.50	3.00
5538	*Platt's Pigeon Mixture.* Frank S. Platt Co., New Haven	Sampled at factory	11.50	2.09	15.00	13.00	4.03	5.00	62.95	4.43	4.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
					Protein (N x 6.25)		Fiber			Fat	
			Water	Ash	Found	Guaranteed, not less than	Found	Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.* *Poultry Feeds—Continued.*										
6000	*Cak-Cak Laying Mash with Buttermilk, Oat Meal, Fish, Meat, etc.* Pratt Food Co., Buffalo, N. Y.	*New Milford:* Geo. E. Ackley & Co.	8.30	8.48	21.25	20.00	5.78	6.00	50.31	5.88	3.00
6320	*Iroquois Laying Mash.* Pratt Food Co., Buffalo, N. Y.	*New Britain:* S. P. Strople	10.30	8.47	20.00	20.00	5.73	8.00	49.59	5.91	5.00
6002	*Iroquois Poultry Mash.* Pratt Food Co., Buffalo, N. Y.	*Ridgefield:* Ridgefield Lumber Co.	8.90	5.44	17.19	15.00	7.03	6.00	56.49	4.95	4.00
6004	*Iroquois Scratching Grains.* Pratt Food Co., Buffalo, N. Y.	*Danbury:* C. S. Barnum & Son	12.58	1.45	10.13	10.00	2.50	5.00	70.59	2.75	3.00
6318	*Pratt's Baby Chick Food with Buttermilk.* Pratt Food Co., Buffalo, N. Y.	*Hazardville:* A. D. Bridges Sons	11.23	8.10	12.63	11.50	2.85	3.80	60.59	4.60	3.50
6234	*Pratt's Circle A Chick Scratch Feed.* Pratt Food Co., Philadelphia, Pa.	*Thompsonville:* Geo. S. Phelps & Co.	12.05	1.51	10.69	10.00	1.40	5.00	72.22	2.13	2.50
6410	*Pratt's Circle A Chick Scratch.* Pratt Food Co., Philadelphia, Pa.	*Thompsonville:* Geo. S. Phelps & Co.	12.55	1.41	10.63	10.00	1.50	5.00	71.86	2.05	2.50
5440	*Pratt's Circle A Large Scratch Feed.* Pratt Food Co., Philadelphia, Pa.	*Bristol:* Bristol Grain & Supply Co.	13.15	1.38	10.00	10.00	2.68	5.00	69.46	3.33	2.50

4809	*Pratt's Supreme Growing Mash.* Pratt Food Co., Philadelphia, Pa.	*Thompsonville:* Geo. S. Phelps & Co.	10.86	8.63	19.19	17.50	4.18	7.00	51.85	5.29	4.50
5951	*Pratt's Supreme Growing Mash with Buttermilk.* Pratt Food Co., Philadelphia, Pa.	*New Britain:* S. P. Strople	9.05	11.11	19.31	17.50	3.85	7.00	51.15	5.53	4.50
5950	*Pratt's Supreme Pigeon Feed with Flint Corn.* Pratt Food Food Co., Philadelphia, Pa.	*New Britain:* S. P. Strople	12.25	1.95	13.00	10.00	2.50	5.00	67.47	2.83	2.50
6321	*Pratt's Victory Chick Scratch Feed.* Pratt Food Co., Philadelphia, Pa.	*New Britain:* S. P. Strople	13.40	1.18	10.88	10.00	1.35	5.00	71.01	2.18	2.50
6596	*Pratt's Victory Chick Scratch Feed.* Pratt Food Co., Philadelphia, Pa.	*New Britain:* S. P. Strople	13.18	1.10	11.25	10.00	1.40	5.00	70.84	2.23	2.50
6594	*Pratt's Victory Large Scratch Feed.* Pratt Food Co., Philadelphia, Pa.	*Norwalk:* Frank Libner & Son	12.98	1.39	10.81	10.00	2.45	5.00	69.27	3.10	2.50
5432	*Pratt's Victory Intermediate Scratch Feed.* Pratt Food Co., Philadelphia, Pa.	*Hartford:* C. A. Pease & Co.	11.73	1.45	10.81	10.00	1.98	5.00	70.93	3.10	2.50
5949	*Pratt's Victory Laying Mash with Buttermilk.* Pratt Food Co., Philadelphia, Pa.	*New Britain:* S. P. Strople	9.08	7.78	21.75	20.00	6.35	8.00	49.61	5.43	4.00
5684	*Egg-Em-On Scratch Grains.* H. C. Puffer Co., Springfield, Mass.	*West Willington:* H. M. Hanson	11.55	1.46	10.81	10.00	2.58	5.00	70.77	2.83	1.50
5200	*Big Egg Scratch Grains, No Grit.* Quaker Oats Co., Chicago, Ill.	*Plainville:* W. S. Eaton	13.05	1.60	10.31	10.00	2.78	4.25	68.73	3.53	3.00
3635	*Ful-O-Pep Chick Starter.* Quaker Oats Co., Chicago, Ill.	*Plantsville:* C. A. Cowles	7.50	10.48	16.75	15.00	4.77	6.00	54.65	5.85	5.00
6406	*Ful-O-Pep Chick Starter.* Quaker Oats Co., Chicago, Ill.	*Hamden:* I. W. Beers	9.10	10.17	16.63	15.00	5.80	6.00	51.67	6.63	5.00
6408	*Ful-O-Pep Fine Chick Feed.* Quaker Oats Co., Chicago, Ill.	*Plainville:* W. S. Eaton	11.83	1.42	12.00	12.00	1.59	2.00	69.58	3.58	2.50
4801	*Ful-O-Pep Growing Mash.* Quaker Oats Co., Chicago, Ill.	*So. Norwalk:* Roodner Feed Co.	12.34	9.98	19.31	19.00	4.58	6.00	47.37	6.42	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, [illegible]

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25)		Fiber		Nitrogen-free extract (starch, gum, etc.)	Fat	
					Found	Guaranteed, not less than	Found	Guaranteed, not more than		Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
5201	*Ful-O-Pep Growing Mash.* Quaker Oats Co., Chicago, Ill.	*Plainville:* W. S. Eaton	8.90	10.15	19.75	19.00	5.23	6.00	50.27	5.70	5.00
5156	*Ful-O-Pep Egg Mash.* Quaker Oats Co., Chicago, Ill.	*Hamden:* I. W. Beers	9.18	11.48	19.94	20.00	6.43	8.00	47.84	5.13	4.00
5203	*Ful-O-Pep Scratch Grains.* Quaker Oats Co., Chicago, Ill.	*Thompsonville:* Geo. S. Phelps & Co.	12.30	1.50	10.50	9.00	2.45	3.50	69.97	3.28	2.00
5559	*Schumacher's Little Chick Feed, No Grit.* Quaker Oats Co., Chicago, Ill.	*Long Hill:* Long Hill Feed Store	11.47	1.43	10.69	10.00	1.48	2.00	71.83	3.10	2.00
5558	*Schumacher's Scratch Grains, No Grit.* Quaker Oats Co., Chicago, Ill.	*Long Hill:* Long Hill Feed Store	11.90	1.58	10.69	10.00	2.73	3.50	69.25	3.85	2.00
6772	*Fine Ground Green Poultry Alfalfa Meal.* Ralston Purina Co., St. Louis, Mo.	*Norwich:* Norwich Grain Co. ..	8.27	12.19	18.56	17.00	21.17	25.00	37.61	2.20	1.60
5441	*Purina Baby Chick Chow.* Ralston Purina Co., St. Louis, Mo.	*Derby:* Peterson-Hendee Co. ..	11.95	1.70	11.25	10.00	2.08	4.00	69.43	3.59	2.00
5301	*Purina Chicken Chowder Feed.* Ralston Purina Co., St. Louis, Mo.	*Manchester:* Manchester Grain Co.	10.03	8.42	19.75	19.00	7.33	8.00	49.27	5.20	4.00

5422	***Purina Chicken Fat Chow Feed.*** Ralston Purina Co., St. Louis, Mo.	*Hartford:* Olds & Whipple, Inc.	9.73	4.51	15.31	15.00	3.35	4.50	62.00	5.10	4.60
5421	***Purina Chicken Fatena Feed.*** Ralston Purina Co., St. Louis, Mo.	*Hartford:* Olds & Whipple, Inc.	10.03	3.26	13.31	12.00	4.73	6.60	63.44	5.23	4.60
3633	***Purina Chick Growena Feed.*** Ralston Purina Co., St. Louis, Mo.	*Middletown:* H. G. Wadhams Co.	9.23	8.73	18.00	18.00	5.68	7.00	52.76	5.60	4.00
5578	***Purina Chick Growena Feed.*** Ralston Purina Co., St. Louis, Mo.	*New Haven:* Moran-Patton Co.	8.00	7.65	18.13	18.00	5.88	7.00	53.61	6.73	4.00
5442	***Purina Chick Startena Feed containing Buttermilk.*** Ralston Purina Co., St. Louis, Mo. ..	*Derby:* Peterson-Hendee Co. ..	9.23	8.51	18.44	17.00	6.50	6.50	50.57	6.75	4.00
5233	***Purina Hen Chow Feed.*** Ralston Purina Co., St. Louis, Mo. ...	*Meriden:* H. Grulich	12.38	1.53	10.06	10.00	2.25	4.00	70.68	3.10	2.50
5579	***Purina Intermediate Hen Chow Feed.*** Ralston Purina Co., St. Louis, Mo.	*New Haven:* Moran-Patton Co.	11.23	1.64	10.63	10.00	2.03	4.00	71.24	3.23	2.50
5420	***Purina Pigeon Chow Feed.*** Ralston Purina Co., St. Louis, Mo.	*Hartford:* Olds & Whipple, Inc.	12.70	1.98	15.63	14.00	2.83	4.00	64.41	2.45	2.00
5891	***Purina Pigeon Chow Feed containing Corn.*** Ralston Purina Co., St. Louis, Mo.	*Middletown:* H. G. Wadhams Co.	11.10	1.76	14.88	14.00	3.13	3.80	66.48	2.65	2.40
5355	***Winner Scratch Feed.*** Ralston Purina Co., St. Louis, Mo. ...	*Middletown:* H. G. Wadhams Co.	12.00	1.42	10.31	10.00	2.18	5.00	71.06	3.03	2.00
5837	***Diamond Scratch Feed.*** Rockville Grain & Coal Co., Rockville	*Manchester:* Manchester Grain Co.	10.70	1.53	10.19	10.00	2.23	4.00	72.12	3.23	3.00
5605	***Advance Egg Mash with Buttermilk.*** Rosenbaum Bros., Chicago, Ill.	*Stratford:* M. Blackley	8.55	9.80	17.56	18.00	7.38	8.00	50.47	6.24	4.00
5674	*77 Scratch Feed, No Grit.*. Rosenbaum Bros., Chicago, Ill.	*Stafford Springs:* Dennis Grain Mill	12.50	1.26	10.13	10.00	1.96	5.00	71.17	2.98	2.00
5675	*Vitality Chick Starter.* Rosenbaum Bros., Chicago, Ill.	*Stafford Springs:* Dennis Grain Mill	9.43	11.22	16.19	15.00	4.73	6.00	53.58	4.85	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
5604	*Vitality Egg Mash.* Rosenbaum Bros., Chicago, Ill.	*Stratford:* M. Blackley	9.03	10.00	20.06	20.00	6.70	8.00	48.33	5.88	4.00
5253	*Vitality Growing Mash.* Rosenbaum Bros., Chicago, Ill.	*Suffield:* Spencer Bros.	9.83	6.13	17.38	15.00	5.93	6.00	55.23	5.50	5.00
5807	*Vitality Pigeon Feed, No Corn, No Grit.* Rosenbaum Bros., Chicago, Ill.	*East Bridgeport:* Kaplan Feed Co.	10.75	1.97	12.00	10.00	3.75	5.00	68.68	2.85	2.50
5683	*Vitality Scratch Feed-NG.* Rosenbaum Bros., Chicago, Ill.	*Stafford Springs:* Dennis Grain Mill	11.88	1.36	10.13	10.00	2.00	5.00	71.38	3.25	2.50
6285	*Homespun Mash.* Paty Schwartz Co., New London	Sampled at factory	10.80	7.57	14.63	15.00	10.05	10.00	51.92	5.03	5.00
5859	*Homespun Scratch Grains.* Paty Schwartz Co., New London	Sampled at factory	11.38	1.55	10.44	10.00	2.70	5.00	70.73	3.20	1.50
5487	*See-More-Egg Buttermilk Mash.* Seymour Grain & Coal Co., Seymour	Sampled at factory	8.90	7.51	21.69	18.00	5.18	7.00	51.24	5.48	4.50
5488	*See-More-Egg Scratch Feed.* Seymour Grain & Coal Co., Seymour	Sampled at factory	12.45	1.45	9.81	10.00	2.65	6.00	70.38	3.26	3.00

5474	*Nelson's Mixed Feed.* Shelton Feed Co., Shelton	Sampled at factory	13.09	1.44	10.00	10.00	2.02	5.00	70.42	3.03	1.50
5657	*Mill Streams "Fortune Hunter" Grains.* Winchell Smith, Inc., Farmington	Sampled at factory	11.92	1.53	11.06	10.00	2.48	3.00	69.96	3.05	2.50
5416	*Mill Streams "Lightnin" Laying Mash.* Winchell Smith, Inc., Farmington	Sampled at factory	9.25	10.22	21.19	16.00	5.93	8.00	48.16	5.25	3.00
6521	*Spratt's Chicgrain.* Spratt's Patent (American), Ltd., Newark, N. J.	*Manchester:* O. E. Bailey	10.93	3.63	15.63	14.00	2.83	4.00	64.00	2.98	3.00
6520	*Spratt's Mash Food with Buttermilk.* Spratt's Patent (American), Ltd., Newark, N. J.	*Manchester:* O. E. Bailey	9.70	4.16	19.88	20.00	3.95	4.00	58.02	4.29	3.50
6269	*King Baby Chick Food containing Buttermilk.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	11.53	4.86	14.06	13.00	3.68	5.00	61.59	4.28	4.50
6268	*King Chick Feed.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	12.10	1.58	11.31	10.50	1.34	4.00	70.17	3.50	2.50
5665	*King Intermediate Chick Feed.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	11.50	1.33	10.81	10.00	1.73	3.50	71.28	3.35	3.00
5662	*King Mash Feed.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	8.28	11.59	21.50	19.50	5.60	7.50	46.99	6.04	4.00
5664	*King Scratch Feed.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	13.00	1.35	10.38	10.00	2.33	5.50	69.91	3.03	3.00
6531	*Paragon Scratch Feed.* St. Albans Grain Co., St. Albans, Vt.	*Stepney:* M. Nusbaum	15.20	1.50	9.56	10.00	2.78	5.00	67.78	3.18	2.50
6405	*Wirthmore Buttermilk Baby Chick Food.* St. Albans Grain Co., St. Albans, Vt.	*Hamden:* I. W. Beers	12.33	6.49	15.38	13.50	3.33	5.00	58.19	4.28	4.50
5155	*Wirthmore Buttermilk Mash Feed with Fish and Meat Scraps.* St. Albans Grain Co., St. Albans, Vt.	*Hamden:* I. W. Beers	10.23	9.99	20.94	20.00	5.70	7.00	47.79	5.35	4.00
6282	*Wirthmore Gritless Chick Feed.* St. Albans Grain Co., St. Albans, Vt.	*Norwich:* Yantic Grain & Products Co.	14.38	1.33	10.56	11.00	1.68	3.50	69.55	2.50	2.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
			Pounds per Hundred								
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
5324	*Wirthmore Growing Feed with Dried Buttermilk and Beef Scrap.* St. Albans Grain Co., St. Albans, Vt.	*Branford:* S. V. Osborn Est.	10.60	8.80	18.44	15.00	5.30	4.50	51.56	5.30	4.50
5862	*Wirthmore Growing Feed with Dried Buttermilk and Beef Scrap.* St. Albans Grain Co., St. Albans, Vt.	*West Cheshire:* Cheshire Grain & Coal Co.	8.90	9.91	18.50	15.00	5.30	4.50	51.31	6.08	4.50
5688	*Wirthmore Intermediate Chick Feed.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Boston Grain Co.	11.55	1.24	10.31	10.00	1.98	3.50	71.77	3.15	3.00
5209	*Wirthmore Scratch Feed.* St. Albans Grain Co., St. Albans, Vt.	*North Haven:* W. L. Thorpe	12.90	1.54	10.06	10.00	2.63	5.00	69.42	3.45	3.00
5349	*Onondaga Scratch Grains.* Syracuse Milling Co., Syracuse, N. Y.	*Higganum:* F. A. Petrofsky	13.48	1.40	9.88	10.00	2.98	5.00	69.41	2.85	3.00
5602	*Symco Scratch Grains.* Syracuse Milling Co., Syracuse, N. Y.	*Long Hill:* Long Hill Feed Store	12.23	1.67	10.38	9.00	2.59	10.00	70.15	2.98	3.00
5761	*Syragold Chick Feed.* Syracuse Milling Co., Syracuse, N. Y.	*Saugatuck:* Saugatuck Grain Co.	10.53	1.72	11.50	10.00	1.50	5.00	70.70	4.05	3.50

	N. Y.	*Southport:* C. Buckingham & Co.	8.88	9.04	23.88	18.00	2.23	4.00	50.79	5.18	3.50
5498	*Syragold Egg Mash.* Syracuse Milling Co., Syracuse, N. Y.	*Torrington:* F. W. Wadhams	9.50	6.55	20.50	18.00	7.75	8.00	50.20	5.50	3.00
5758	*Syragold Growing Mash.* Syracuse Milling Co., Syracuse, N. Y.	*Southport:* C. Buckingham & Co.	9.48	5.10	19.00	16.00	3.88	7.00	57.41	5.13	4.00
5947	*Syragold Scratch Grains.* Syracuse Milling Co., Syracuse, N. Y.	*Kensington:* I. F. Labieniec	12.28	1.37	10.00	10.00	2.38	5.00	71.32	2.65	3.00
5887	*Syragold Scratch Grains.* Syracuse Milling Co., Syracuse, N. Y.	*Manchester:* O. E. Bailey	12.85	1.51	10.50	10.00	2.78	5.00	69.28	3.08	3.00
3638	*Thomaston Egg Mash.* Thomaston Supply Co., Thomaston	Sampled at factory	8.55	11.53	19.81	20.00	6.68	7.00	47.68	5.75	3.50
5499	*Thomaston Egg Mash.* Thomaston *Supply Co., Thomaston*	Sampled at factory	8.95	10.40	21.25	20.00	7.09	7.00	47.22	5.09	4.00
3640	*Thomaston Scratch Feed.* Thomaston Supply Co., Thomaston	Sampled at factory	11.25	1.61	10.63	10.00	2.89	5.00	70.72	2.90	3.00
5501	*Thomaston Scratch Feed.* Thomaston Supply Co., Thomaston	Sampled at factory	12.60	1.53	10.00	10.00	2.63	5.00	70.41	2.83	3.00
6575	*Chicatine.* Tioga-Empire Feed Mill, Waverly, N. Y.	*Hawleyville:* W. A. Honan	9.68	7.07	20.75	18.00	4.25	6.00	53.15	5.10	3.00
5590	*Egatine.* Tioga Mill & Empire Co., Waverly, N. Y.	*Hawleyville:* W. A. Honan	9.15	8.71	26.25	23.00	5.00	6.00	45.49	5.40	2.50
5586	*Tioga Growing Mash.* Tioga Mill & Empire Co., Waverly, N. Y.	*Hawleyville:* W. A. Honan	9.53	5.67	15.13	12.00	5.44	6.00	59.33	4.90	2.00
5589	*Tioga Laying Food.* Tioga Mill & Empire Co., Waverly, N. Y.	*Hawleyville:* W. A. Honan	9.68	8.02	21.00	17.00	4.98	6.00	50.94	5.38	2.50
5848	*Tioga Poultry Grains.* Tioga Mill & Empire Co., Waverly, N. Y.	*Glenbrook:* Davis-Schofield Co.	12.33	1.45	9.94	9.00	2.23	4.79	71.35	2.70	2.08
5588	*Derby Scratch Feed.* Tioga Mill & Empire Co., Waverly, N. Y.	*Hawleyville:* W. A. Honan	12.83	1.48	9.94	9.00	2.65	4.50	69.98	3.12	7.04

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1926—*Continued.*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued.*										
	Poultry Feeds—Continued.										
6592	*Chicklet Intermediate Chick Feed.* United Flour & Feed Co., Albany, N. Y.	*Winsted:* C. R. Hawley	14.38	1.22	9.44	10.00	1.44	5.00	70.97	2.55	3.00
5569	*Rex Scratch Feed.* United Flour & Feed Co., Albany, N. Y.	*Winsted:* C. R. Hawley	12.63	1.50	10.31	10.00	2.30	5.00	70.03	3.23	3.00
5570	*United Laying Mash with Buttermilk.* United Flour & Feed Co., Albany, N. Y.	*Winsted:* C. R. Hawley	9.73	10.69	20.06	20.00	5.25	7.00	49.29	4.98	4.00
5438	*United Laying Mash, Storrs Formula.* United Flour & Feed Co., Albany, N. Y.	*Weatogue:* R. B. Eno	9.65	10.01	20.94	20.00	5.85	7.00	48.18	5.37	4.00
5585	*Eventually Gold Medal Vitamine Egg Mash.* Washburn-Crosby Co., Minneapolis, Minn.	*New Milford:* Geo. T. Soule	8.33	7.26	20.50	20.00	6.51	8.50	51.55	5.85	5.00
5892	*North Star Scratch Feed, No Grit.* Washburn-Crosby Co., Minneapolis, Minn.	*North Haven:* W. L. Thorpe	12.05	1.43	9.75	10.00	2.50	5.00	71.22	3.05	2.50
5744	*Big Y Growing Feed.* Yantic Grain & Products Co., Norwich	Sampled at factory	8.18	7.82	20.38	17.00	6.58	6.00	51.45	5.59	4.00

	Beef Scrap, etc.										
3631	*Capital Meat and Bone Scrap.* American Agricultural Chemical Co., New York	*New Haven:* Amer. Agric. Chem. Co.	6.75	31.50	45.56	45.00	....	3.00	6.52	9.67	6.00
5716	*Capital Beef Scrap.* American Agricultural Chemical Co. New York	*New Milford:* W. L. Richmond & Son	7.53	33.51	46.38	45.00	1.95	3.00	1.68	8.95	6.00
3630	*Protox Meat and Bone Scrap.* American Agricultural Chemical Co., New York	*New Haven:* Amer. Agric. Chem. Co.	6.08	24.07	55.25	55.00	....	3.00	3.60	11.00	6.00
5715	*Protox Beef Scrap.* American Agricultural Chemical Co., N. Y.	*New Milford:* W. L. Richmond & Son	6.95	24.55	54.75	55.00	2.40	3.00	....	11.35	6.00
5689	*Beach's Star Brand Beef Scrap.* Beach Soap Co., Lawrence, Mass.	*Willimantic:* Windham Grain Store	7.00	26.09	48.88	35.00	1.85	2.50	2.75	13.43	10.00
5337	*Collis Process Pure Dried Buttermilk.* Collis Products Co., Clinton, Iowa	*Guilford:* Fred C. Morse	10.48	11.47	32.25	30.00	....	....	38.77	7.03	5.00
5163	*Meat Scrap.* Conn. Fat Rendering & Fertilizer Corp., New Haven	*Hamden:* I. W. Beers	8.15	29.21	50.25	40.00	....	....	1.96	10.43	10.00
5341	*Cooked Meat Scrap.* Conn. Fat Rendering & Fertilizer Corp., New Haven	*Guilford:* F. H. Rolf	7.28	19.85	59.25	50.00	....	....	1.57	12.05	10.00
5372	*Chikora.* Dry Milk Co., New York	*New Britain:* C. W. Lines Co.	7.70	8.04	38.31[1]	35.00	....	....	49.72	1.23	1.00
5322	*Frisbie's Bone Meal 20/25% Protein (for Cattle and Poultry),* L. T. Frisbie Co., New Haven	*East Haven:* A. W. Forbes	7.60	15.33	24.88	20.00	....	....	51.39	0.80	2.00
5806	*Frisbie Bone and Meat Meal.* L. T. Frisbie Co., New Haven	Sampled at factory	2.80	42.47	30.44	35.00	....	....	7.71	16.58	8.00
6232	*Frisbie's Bone and Meat Meal 35/45% Protein.* L. T. Frisbie Co., New Haven	Sampled at factory	5.80	25.75	49.38	35.00	....	....	4.99	14.08	8.00

[1] On a 3% moisture basis, protein 35%.

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1916—*Concluded.*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Concluded.* *Poultry Feeds—Concluded.* *Beef Scraps—Concluded.*										
5189	*Frisbie's Poultry Feed 45.* L. T. Frisbie Co., New Haven	*Plantsville:* C. A. Cowles	6.08	31.05	47.50	45.00	....	....	2.12	13.25	8.00
5472	*Frisbie's Poultry Feed 55/65% Protein.* L. T. Frisbie Co., New Haven	*Shelton:* Shelton Feed Co.	5.98	23.96	56.00	55.00	....	....	1.46	12.60	8.00
5673	*Cooked Meat Scrap.* A. G. Markham & Co., Springfield, Mass.	*West Stafford:* C. P. Bradway	7.90	30.82	48.81	45.00	....	....	3.22	9.25	8.00
5676	*Cooked Meat Scrap.* A. G. Markham & Co., Springfield, Mass.	*Stafford Springs:* Dennis Grain Mill	5.65	28.26	51.50	50.00	....	....	1.79	12.80	8.00
6278	*Marsh's Pure Ground Scraps for Poultry.* Geo. E. Marsh Co., Lynn, Mass.	*Bloomfield:* Bloomfield Farmers' Exchange	5.70	32.01	41.63	40.00	....	....	6.96	13.70	8.00
3451	*Beef Scrap.* Middlesex Refining Co., Middletown	Sampled at factory	6.00	14.68	55.88	55.00	....		1.64	21.80	24.00
5191	*Blue Seal Meat Scraps.* New England By-Products Co., Lawrence, Mass.	*Plainville:* M. Kosenko	7.35	31.14	49.56	50.00	1.63	3.00	1.87	8.45	3.00
5592	*White Seal Meat Scraps.* New England By-Products Co., Lawrence, Mass.	*Hawleyville:* W. A. Honan	6.83	40.30	39.63	40.00	1.30	4.00	1.09	10.85	5.00
5320	*Norton's High Grade Meat and*										

	Bone. Norton Tallow Co., Somerville, Mass.	*New Canaan:* Clapboard Hill Feed Co.	5.43	36.57	38.94	45.00	....	....	5.68	13.38	8.00
3634[1]	*Norton's Meat and Bone Poultry Food.* Norton Tallow Co., Somerville, Mass.	*Plantsville:* C. A. Cowles	5.85	33.41	42.75	45.00	....	....	5.10	12.89	8.00
5199	*Meato.* E. Rauh & Sons, Indianapolis, Ind.	*Plainville:* M. Kosenko	4.98	6.93	74.56	75.00	0.65	2.00	....	12.88	8.00
5800	*Reardon's 45% Meat Scraps.* John Reardon & Sons Co., Cambridge, Mass.	*Westerly:* C. W. Campbell Co...	5.05	36.12	45.06	45.00	1.48	3.00	2.34	9.95	6.00
5799	*Reardon's 55% Meat Scraps.* John Reardon & Sons Co., Cambridge, Mass.	*Westerly:* C. W. Campbell Co...	6.00	30.16	53.94	55.00	1.70	3.00	0.35	7.85	6.00
6283	*Reardon's 55% Meat Scraps.* John Reardon & Sons Co., Cambridge, Mass.	*Westerly:* C. W. Campbell Co...	6.98	30.83	51.88	55.00	1.28	3.00	1.75	7.28	6.00
5631	*Chapman's Special Odorless Steamed Bone Meal.* Riverdale Products Co., Chicago, Ill. ...	*Guilford:* Fred C. Morse	2.10	88.84	5.13	5.00	....	2.00	3.44	0.49	1.50
6010	*Chapman's Special Odorless Steamed Bone Meal.* Riverdale Products Co., Chicago, Ill. ...	*Middletown:* Meech & Stoddard, Inc.	7.73	81.32	5.94	5.00	....	2.00	4.53	0.48	1.50
4796	*Bone Meal.* Springfield Rendering Co., Springfield, Mass. ...	*Stafford Springs:* Stafford Granary	5.84	65.83	16.31	20.00	....	....	3.08	8.94	6.00
5497	*Springfield Bone Meal.* Springfield Rendering Co., Springfield, Mass.	*Torrington:* Litchfield Co-op. Assoc.	5.93	61.72	22.88	20.00	....	....	3.39	6.08	6.00
5184	*Springfield Ground Meat Scraps.* Springfield Rendering Co., Springfield, Mass.	*Plantsville:* Mehmel & Sarvi ...	8.53	30.45	50.13	45.00	....	....	1.74	9.15	8.00
6205	*Stanley's Meat Scrap.* John T. Stanley Co., Inc., New York..	*Long Hill:* Long Hill Feed Store	5.73	31.40	43.69	45.00	1.66	3.00	5.32	12.20	10.00
5686	*P & W Meat Scrap.* Worcester Rendering Co., Auburn, Mass.	*Merrow:* I. F. Wilcox	6.20	33.14	46.19	45.00	1.70	6.00	1.72	11.05	8.00
5685	*P & W Special Meat Scrap.* Worcester Rendering Co., Auburn, Mass.	*Merrow:* I. F. Wilcox	5.55	20.91	57.69	55.00	1.81	5.00	1.34	12.70	8.00

[1] Wire tags illegal.

TABLE II. ANALYSES OF FEED SUBMITTED BY INDIVIDUALS.

Station No.	Material	Submitted by	Pounds per Hundred: Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free extract (starch, gum, etc.)	Ether extract (crude fat)	Remarks
	BREWERS' AND DISTILLERS' PRODUCTS.								
6348	Dried Corn Distillers' Grain	*Waterloo, N. Y.:* Waterloo Distilling Corp.	7.08	3.51	28.69	9.68	39.99	11.05	
6422	Corn Distillers' Grains	*New Canaan:* Clapboard Hill Feed Co.	6.63	1.82	25.88	10.65	45.67	9.35	
	COTTONSEED PRODUCTS.								
4847	Standard Brand Cottonseed Feed	*Middletown:* The Coles Co.	....	....	35.94	....	....	....	Guaranty: protein 36%.
	PROPRIETARY MIXED FEEDS. *Dairy Rations, etc.*								
4876	Dairy Feed, Own Formula	*Middletown:* H. O. Daniels	10.14	5.08	*21.31*	*8.61*	*49.78*	5.08	
3418	Dairy Feed	*Willimantic:* Reuben Fishbein	....	....	24.69	....	....	5.53	
3380	Dairy Ration A	*Torrington:* Litchfield County Co-op. Assoc.	10.45	6.50	20.88	8.00	48.69	5.48	
3381	Dairy Ration B	*Torrington:* Litchfield County Co-op. Assoc.	9.75	6.65	22.00	7.50	48.47	5.63	
3774	Eastern States Full Pail Dairy Ration	*Storrs:* Conn. Agr. College	5.38	7.08	21.88	7.16	53.42	5.08	
5641	Wirthmore Dairy Feed	*Newington:* Thomas Holt	9.98	6.07	21.44	7.01	50.32	5.18	
6028	Talcott's Economy Dairy Ration	*Torrington:* Louis B. Merriman	6.20	6.00	24.19	9.15	49.71	4.75	
3450	Dairy Feed	*Torrington:* Clark Weed	7.80	....	24.81	7.50	....	5.08	
[illegible]	Lancaster 20% Dairy	*Norwalk:* Frank Libner & Sons	8.83	7.37	22.88	12.20	42.54	6.18	

[illegible]	Rex Stock Feed	*Middletown:* Meech & Stoddard, Inc.	....	5.83	10.13	....	....	4.40
	Poultry Feeds.							
4271	Beef Scrap No. 1	*Ballouville:* J. Z. LaBelle	6.66	....	47.63	none	....	10.55
4272	Beef Scrap No. 2	J. Z. Labelle	5.95	....	48.50	none	....	15.05
3387	Meat Scraps	*Middletown:* Middlesex Refining Co.	5.25	8.08	60.25	0.39		26.03
3069	Meat Scraps	*Norwich:* The Yantic Grain & Products Co.	6.95	....	40.13	....	....	12.08
6773	Norton's H. G. Meat and Bone..	*So. Coventry:* E. W. Latimer ..	5.96	31.45	44.94	1.25	3.42	12.98
4898	Albert Angell Jr. Chick Starter	*Brooklyn:* Victor Takanan	....	....	17.13	4.42	....	5.14
4900	Albert Angell Jr. Chick Starter	Victor Takanan	....	....	16.44	4.51	....	4.94
5424	Dry Mash (Home Mixed)	*No. Westchester:* Rev. A. W. Carney	10.48	6.71	16.06	5.86	55.51	5.38
4260	Dry Mash	*Kensington:* S. F. Labieniec ...	8.65	....	19.94	7.63	....	5.80
5993	Beacon Egg Mash with Buttermilk	*Little River:* Walnut Crest Poultry Farm	8.85	8.87	21.63	5.98	48.92	5.75
6009	Fortune Egg Mash	*Middletown:* The Coles Co.	8.30	....	17.00	5.73	....	5.28
5992	Park & Pollard Lay or Bust Egg Mash	*Little River:* Walnut Crest Poultry Farm	10.50	7.44	19.25	7.10	50.43	5.28
4899	Albert Angell Jr. Growing Mash	*Brooklyn:* Victor Takanan	....	....	16.94	4.80	....	5.05
3417	Laying Mash	*Willimantic:* Reuben Fishbein ..	....	....	21.88	....	....	6.80
5909	Laying Mash (Own Mixture) ..	*Torrington:* Litchfield County Co-op. Assoc.	10.15	8.92	16.44	6.03	53.78	4.68
	MISCELLANEOUS.							
3691	Alfalfa Flour	*Norwich:* The Yantic Grain & Products Co.	2.93	....	20.75	15.25	....	3.08
3433	Beet Pulp No. 1	*Shelton:* Wolf's Feed Store ...	6.45	....	10.88	18.33	....	1.24
3434	Beet Pulp No. 2	Wolf's Feed Store	5.68	....	10.94	18.11	....	0.93
3435	Beet Pulp No. 3	Wolf's Feed Store	4.70	....	10.50	18.49	....	1.08
3436	Beet Pulp No. 4	Wolf's Feed Store	4.58	....	11.25	18.35	....	0.88
3437	Beet Pulp No. 5	Wolf's Feed Store	4.68	....	11.31	24.63	....	1.43
5314	By-Product from Cracking Corn	Station Agent (unofficial)	12.43	1.27	6.38	7.28	70.71	1.93
6259	Cracked Corn	Station Agent (unofficial)	11.83	1.38	9.75	1.73	71.76	3.55
5735	Cracked Corn	*Syracuse, N. Y.:* Syracuse Milling Co.	11.56	1.10	9.50	1.59	72.97	3.28

TABLE II. ANALYSES OF FEED SUBMITTED BY INDIVIDUALS—*Concluded.*

Station No.	Material	Submitted by	Pounds per Hundred: Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free extract (starch, gum, etc.)	Ether extract (crude fat)	Remarks
	MISCELLANEOUS—*Concluded.*								
34426	Dry Buttermilk No. 1	*Hartford:* Dairy and Food Commissioner	9.83	8.80	33.25	....	....	4.04	Acidity (calculated as lactic acid) 6.08%.
34426	Dry Buttermilk No. 2	Dairy and Food Commissioner	9.34	7.49	36.56	....	....	0.90	Acidity (calculated as lactic acid) 4.73%.
3910	Dried Buttermilk	Dairy and Food Commissioner	10.00	10.30	30.90	....	43.80	5.00	
3909	Powdered Skim Milk	Dairy and Food Commissioner	10.00	7.90	33.90	....	47.60	0.60	
5454	Harlax Semi-Solid Buttermilk	*Jewett City:* Red Wing Feed Store	66.60	2.14	22.14	0.00	7.49	1.63	
1789	Semi-Solid Buttermilk	*Ballouville:* J. Z. LaBelle	76.16	2.43	....	....	....	0.32	Solids: 23.84%.
6888	Feed-Ax7-I	*Gildersleeve:* John H. Fay	7.72	7.59	30.63	6.57	42.43	5.06	
6889	Feed-Ax7-II	John H. Fay	7.60	7.16	31.44	6.74	41.54	5.52	
6345	Feed	*Hartford:* Leonard H. Healey	10.53	....	17.94	5.92	....	5.88	
7005	Feed	*New Haven:* Moran-Patton Co.	9.05	6.75	17.44	12.39	50.08	4.29	
4821	Feed No. 1	*Bethany:* Sherman P. Woodward	11.79	....	20.63	8.18	....	4.96	
4822	Feed No. 2	Sherman P. Woodward	10.58	....	21.50	8.65	....	5.69	
7195	Feed No. 1	Sherman P. Woodward	9.50	7.18	21.31	7.70	49.10	5.21	
7196	Feed No. 2	Sherman P. Woodward	10.02	5.11	20.75	8.56	51.07	4.49	
7197	Feed No. 3	Sherman P. Woodward	10.17	7.89	21.88	7.32	47.99	4.75	

4230	Ground Oats	*Stepney:* H. Goldman	9.71	3.46	11.81	10.05	60.61	4.36
3908	Ground Oats	*Newington:* Thomas Holt	8.83	....	12.38	10.63	....	5.35
4921	Mixed Feed	*West Cheshire:* Cheshire Grain & Coal Co.	10.56	....	21.25	7.53	....	5.07
3646	Austin's Puppy Bread	*New Haven:* Dr. DeVita	4.05	1.92	16.31	0.68	73.92	3.12
3648	Cero-Meato	Dr. DeVita	4.78	5.21	16.50	0.95	69.23	3.33
3647	Old Trusty "All Terrier Food"	Dr. DeVita	4.43	1.72	17.13	0.77	73.43	2.52
3649	Old Trusty "Puppy Cakes"	Dr. DeVita	5.78	5.31	20.44	0.74	63.65	4.08
3442	Milk-Bone Dog Food	Dr. DeVita	6.28	3.10	16.81	0.70	69.99	3.12
3443	Milk-Bone Puppy Food	Dr. DeVita	6.18	4.15	17.00	0.78	68.15	3.74
3445	Old Mother Hubbard Dog Biscuit	Dr. DeVita	6.30	2.84	18.38	0.85	68.11	3.52
3441	Spratt's Cat Food—With Fish	Dr. DeVita	5.60	4.40	23.75	0.98	60.60	4.67
3440	Spratt's Cod Liver Oil Cakes	Dr. DeVita	5.88	3.39	19.56	0.86	65.47	4.84
3447	Spratt's Fibo	Dr. DeVita	5.98	3.39	20.63	0.68	65.86	3.46
3439	Spratt's Meat-Fibrine Dog Cakes	Dr. DeVita	6.40	3.21	19.69	0.85	65.88	3.97
3446	Spratt's Ovals	Dr. DeVita	5.90	2.85	19.50	0.68	67.61	3.46
3438	Spratt's Puppy Meal	Dr. DeVita	6.25	3.33	20.00	0.90	65.86	3.66
3444	Spratt's "Vito"	Dr. DeVita	4.93	6.23	24.81	2.30	57.18	4.55
5315	Whole Wheat, Red Wheat	*Thomaston:* Thomaston Supply Co.	14.03	1.53	10.25	1.83	70.51	1.85
6774	Dairy Feed No. 1	*Chester:* Leet Bros.	7.88	9.58	21.06	8.05	48.88	4.55
6775	Dairy Feed No. 2	Leet Bros.	6.90	7.40	26.56	9.70	44.58	4.86
6776	Dairy Feed No. 3	Leet Bros.	7.10	7.08	21.63	10.08	48.63	5.48
6777	Dairy Feed No. 4	Leet Bros.	7.82	6.33	25.44	8.00	46.96	5.45
6778	Chick Starter No. 5	Leet Bros.	7.70	7.55	16.69	2.95	60.33	4.78
6779	Chick Starter No. 6	Leet Bros.	8.35	3.92	15.81	2.78	63.96	5.18
6780	Calf Meal No. 7	Leet Bros.	8.70	4.12	24.00	3.41	54.74	5.03
7226	Ground Corn (Farm Waste)	*Milford:* E. B. Clark Seed Co.	11.24	....	11.75	2.93	....	7.58
7227	Reground Early Evergreen Corn	E. B. Clark Seed Co.	10.48	....	10.81	3.26	....	7.96
7228	Reground Golden Bantam Corn	E. B. Clark Seed Co.	6.63	....	11.00	1.91	....	7.75

Miscellaneous Examinations.

Miscellaneous materials submitted by individuals have been examined as follows:

No.	Material	Remarks
6177	*Alfalfa Meal.*	Compared with samples of authentic alfalfa, the sample submitted appeared to be genuine.
7030	*Bird Seed.*	Mixture consisted of canary seed and rape seed. Other seeds practically none.
7011 7071	*Chick Starting Feed.*	7011. The usual grains with a milk product and bone meal were present. Epsom salt also identified. 7071. The usual grains with milk product, meat scrap, bone meal, were present. Calcium carbonate and salt also present. No Epsom salt.
5329	*Corn Meal.*	Finely ground meal. No foreign starch or other foreign material detected.
4048	*Dairy Ration.*	No ingredients other than those mentioned in the formula were found. No evidence of injurious materials detected.
5508	*Dairy Ration.*	Complaint that cows refused to eat the feed. Only standard ingredients detected. No salt was found. Cows accustomed to salt in ration might find feed unpalatable.
3797	*Feed.*	Suspected of containing a poisonous substance. Feeding tests on small animals over a period of 48 hours developed no unfavorable symptoms.
5362	*Meat Scrap.*	Odor and general appearance O. K. Salt content 1.00 per cent.
5004	*Poultry Mash.*	Thought to have caused injury to chicks. Microscopic examination negative; salt content low, 0.3 per cent.
4941	*Unknown substance found in carload of hay.*	Qualitative tests indicated that the material was probably clay.

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Tobacco Station Bulletin 7 March, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

THE PHOSPHORUS REQUIREMENTS OF OLD TOBACCO SOILS

P. J. Anderson, M. F. Morgan, and N. T. Nelson

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

PHOSPHORUS is necessary for the growth of tobacco but an acre of tobacco removes less than seven pounds annually.

Very little leaches away and, since it can get out in no other way, large quantities have accumulated in our old tobacco soils through continuous heavy fertilizer applications.

The *unused supply does not revert to an unavailable form, forever beyond the reach of succeeding crops.* The old tobacco fields show a larger supply of easily soluble phosphorus as well as of total phosphorus than is found in newer fields.

Plots which received no phosphorus (other than that in cottonseed meal and castor pomace) for five years produced just as much and just as good tobacco *as plots which had various quantities of phosphorus* applied.

On old tobacco fields it is reasonable to believe that the grower may greatly reduce or even eliminate phosphorus carriers from his fertilizer mixture for many years without harm.

There is no danger that this practice will deplete the soil of its phosphorus supply since the organic constituents of the usual fertilizer mixture contain four times as much of this element as is lost annually.

A very large part of New England's thirty-five thousand acres of tobacco is grown on old tobacco land. The annual bill for phosphorus on these acres is approximately a quarter of a million dollars. At least half of it is unnecessary.

The Phosphorus Requirements of old Tobacco Soils

P. J. Anderson,[1] M. F. Morgan,[2] and N. T. Nelson[3]

Phosphorus is an essential element for the growth of all plants and tobacco is no exception to the rule. The soil is the only source from which the plant can derive phosphorus. It is therefore essential that roots in this soil always be in contact with a sufficient supply of phosphorus in a form which they can take up. Tobacco, however, is not a very heavy feeder on phosphorus as compared with corn or most other crops. About 15 lbs. of phosphoric acid* is enough for an 1800 lb. crop of tobacco. The crop uses over 5 times as much nitrogen and 9 times as much potash as phosphoric acid. Yet the grower for many years has applied almost as much phosphorus to his soils as he has of nitrogen or potash. Is this necessary or has he been wasting his money to supply what is not needed? What is the minimum amount which he needs to produce a crop of good yield and quality?

In order to answer these questions, a series of plot experiments was begun at the Windsor Tobacco Substation in 1922. These experiments have been continued on the same plots for five years. The results of the first four years have been published previously in Bulletins 5 and 6 of the Tobacco Series of this station. In the present bulletin it is our purpose first to describe the results of the fifth year's trials, then to summarize the experiments of the 5 years. This will be followed by a more general discussion of the whole phosphorus problem as related to the growing of tobacco.

Plot Tests at the Windsor Station

Plan of the field tests. Twelve plots, each containing one-fortieth of an acre, were located on Field I of the experiment station farm at Windsor. Tobacco has been grown most of the time on this field for a generation or more† before it was acquired by the station and it had a reputation of producing good tobacco. The

[1] In charge, Tobacco Station. [2] In charge, Soil Investigations at New Haven.
[3] Physiologist at Tobacco Station.

* *Phosphorus* (P), the chemical element, does not occur in nature in a free state but always in combination. In the chemical analyses of fertilizers the percentage is expressed in terms of *phosphoric acid* (p. 205). Both this and the term *phosphorus* are in common use. To convert figures for *phosphoric acid* to *phosphorus*, multiply by .44; the reverse may be accomplished by multiplying by 2.3.

† We do not have an exact cropping record of this field previous to 1922. It was in grass in 1921.

soil is a sandy loam of the Merrimac series and appears quite uniform but a survey by the Soils Department showed some variation. With the object of overcoming variation which might be produced in yield or quality by soil differences, the three replicate groups of plots were located on different parts of the field. All plots received the same quantity of nitrogen, potash, and magnesia but there were four different rates of application of phosphoric acid as indicated in Table 1.

TABLE 1. COMPOSITION OF THE FERTILIZER MIXTURES AND QUANTITY OF PHOSPHORIC ACID.

	Pounds of Carrier per Acre			
Name of Carrier	Plots P2, P2*, P2**	Plots P3, P3*, P3**	Plots P1, P1*, P1**	Plots P4, P4*, P4**
Cottonseed meal	1,463.4	1,463.4	1,463.4	1,463.4
Castor pomace	588.2	588.2	588.2	588.2
Nitrate of soda	212.7	212.7	212.7	212.7
Precipitated bone ...	None	122.1	277.9	485.7
Sulf. of potash	172.2	172.2	172.2	172.2
Carb. of potash	132.5	132.5	132.5	132.5
Lbs. of P_2O_5	53†	100‡	160‡	240‡

In the P2 formula, all *special* carriers of phosphorus were omitted but it is not practical to reduce the phosphorus content to zero because nearly all growers use considerable organics such as cottonseed meal and castor pomace, all of which contain small quantities of phosphorus.

PLOT TESTS AT THE WINDSOR STATION IN 1926

The fertilizer was applied May 22. All plots were set on June 4 with Havana seed plants of uniform size. All cultural operations were the same throughout the growing season. All were harvested on August 16.

No differences in growth or development were observed during the summer. There was no hastening or retarding of maturity on any of the plots as compared with the others. The growing season was unusually dry until about time for harvesting. The curing season on the other hand was marked by long continued periods of rainy weather which caused some pole-sweat in these plots. It was especially bad in plots P1 and P2**. The cured tobacco was sorted in the sorting shop of the Tobacco Station by experienced sorters. Since the percentage of pole-sweat was not uniform in the different plots, it was necessary to sort the brokes into the respective grades to which they would have belonged if

* Asterisks are used throughout to denote first (*) and second (**) replications.

† Only that which is in the cottonseed meal and castor pomace.

‡ In precipitated bone, in addition to cottonseed meal and castor pomace.

they had not been spoiled by sweat. In the tables given below, the weight of these sorted brokes is added to that of their supposed respective grades because it is not at all probable that the degree of pole-sweat has any relation to percentage of phosphorus in the fertilizer.

Careful observations were made during the sorting to see whether there were any differences in color, body or veins. Although some slight differences between plots were recorded, they were not consistent when compared with replicates. In general the tobacco from plots which received no phosphorus seemed a little superior in having less prominent veins and the quality was just as good as, if not a little superior to, any of the others. Samples from the light wrappers, medium wrappers, dark wrappers and long seconds were kept from each plot and later were submitted to experts, Messrs. J. W. Alsop and Walter Edwards of the Connecticut Valley Tobacco Association, for judging and pooling. The forty-eight samples were assigned by them to three different pools but the differences were not consistently in favor of any one treatment when all the replicates were compared.

The sorting record, acre yield and grade index* are presented below in Table 2. The acre yields were calculated from the weights after sorting and sizing. If they had been calculated on the bundle weights they would have been somewhat larger. Since there was apparently a fertility difference in the different parts of the field, each group of four is averaged and the deviation from that particular average recorded for each plot. This brings out more clearly any difference due to the fertilizer treatment—as opposed to differences due to character of the soil.

From a study of the data presented in this table it is apparent that the differences both in yield and in quality (as indicated by the grade index) between the plots treated with different quanti-

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* *The Grade Index.* In comparing the quality of tobacco grown on different plots it is very difficult to keep in mind the percentage of six to eight commercial grades of tobacco from one plot and compare with a like number from another. To simplify these comparisons a grade index was devised. The grade index is a single number expressing the quality of *all* the tobacco grown on a particular plot. It is based on the percentage of carefully assorted commercial grades and the relative price value of the different grades. Although market prices vary from year to year, it was found, after consultation with experienced dealers, that the ratios of prices between the different grades are fairly constant. These adopted price relationships for the different grades are as follows:

(L)	Light wrappers	1.00	(LD)	Long darks (19″ up)	.30
(M)	Medium wrappers	.60	(DS)	Dark stemming (17″)	.20
(LS)	Long sec. (19″ up)	.60	(F)	Fillers	.10
(SS)	Short seconds (15″ and 17″)	.30	(Br)	Brokes	.01

The grade index of any plot is obtained by multiplying the percentage of each grade by the price in the above schedule and adding the products.

TABLE 2. FIELD TESTS AT WINDSOR, 1926. ACRE YIELD AND SORTING RECORDS.

Plot No.	Acre Yield: Pounds	Acre Yield: Group Average	Acre Yield: Deviation from Average %	Percentage of Grades: L	M	LS	SS	LD	DS	F	Br	Grade Index	Group Average	% Deviation from Average
P1	1802	1811	—0.5	17	12	22	1	35	0	9	4	.495	.482	+2.8
P2	1796		—0.8	15	11	28	1	35	0	9	1	.502		+3.9
P3	1823		+0.7	11	7	31	2	39	0	10	1	.472		—2.1
P4	1822		+0.6	10	4	34	2	37	1	11	1	.459		—4.7
P1*	1900	1896	+0.2	14	7	26	5	41	0	5	2	.483	.506	—4.5
P2*	1943		+2.5	25	10	18	4	33	0	8	2	.539		+6.5
P3*	1881		—0.8	18	7	23	3	37	1	10	1	.493		—2.5
P4*	1860		—1.9	19	9	23	3	35	1	9	1	.508		+0.4
P1**	1656	1724	—3.9	14	6	25	4	42	0	8	1	.473	.479	—1.3
P2**	1724		+0.0	15	8	25	2	39	1	9	1	.483		+0.9
P3**	1744		+1.2	19	11	20	4	34	0	10	1	.501		+4.6
P4**	1772		+2.8	14	11	18	3	41	1	11	1	.460		—3.9

SUMMARY OF TABLE 2

Plot No.	Pounds Phos. Acid per A.	Average Yield in lbs.	Average Grade Index
P1, P1*, P1**	160	1,786	.484
P2, P2*, P2**	53	1,821	.508
P3, P3*, P3**	100	1,816	.489
P4, P4*, P4**	240	1,818	.476

ties of phosphoric acid are too small to be significant and that they are not consistently in favor of any one treatment. Although we are not inclined to call any of these differences significant, nevertheless the fact that even these small differences are in favor of the plots which received no phosphoric acid (in special carriers) indicates, at least, that nothing was gained during 1926 by the addition of any quantity of phosphoric acid to the fertilizer.

SUMMARY OF THE FIVE YEAR EXPERIMENT ON RATE OF *APPLICATION OF PHOSPHORIC ACID*

Since this experiment has now been in progress for five years it is now possible to bring together the data and analyze the results. During this period each treatment has been replicated fifteen times. Since the quantity of fertilizer applied during the first three years was considered excessive, it was reduced during the fourth and fifth years. The reduction in the quantity of phosphoric acid thus effected was:

P2	plots	reduced	from	75	to	53	lbs.	per	acre.
P3	"	"	"	190	"	100	"	"	"
P1	"	"	"	225	"	160	"	"	"
P4	"	"	"	306	"	240	"	"	"

No *special* phosphorus carriers were used at any time on the P2 plots, while the quantity applied to the P4 plots was much in excess of common practice. Intermediate quantities were applied to the P1 and P3 plots.

The experiment was designed to answer two questions: (1) effect of varying rates of application of phosphoric acid on the *yield* and (2) effect on the *quality* of the tobacco. The answer to the first question may be found in Table 3 where the plot yields for the five years are recorded individually and the averages for each plot computed.

TABLE 3. FIELD TESTS AT WINDSOR. YIELD IN POUNDS PER ACRE FOR FIVE YEARS

Plot No.	Yield in Pounds per Acre 1922†	1923†	1924	1925	1926	Average for 5 Yrs.	Average of the 15 Replications	Five Yr. Total P_2O_5 Lbs.
P1	1,419	1,919	1,493	1,894	1,802	1,705	1,662	995
P2	1,425	1,863	1,413	1,879	1,796	1,675	1,663	331
P3	1,456	1,826	1,493	1,742	1,823	1,668	1,649	770
P4	1,386	1,853	1,387	1,826	1,822	1,655	1,648	1,398
P1*	1,419	1,919	1,387	1,753	1,900	1,678	....	....
P2*	1,425	1,863	1,387	1,885	1,943	1,701	....	....
P3*	1,456	1,826	1,360	1,899	1,881	1,684	....	....
P4*	1,386	1,853	1,333	1,886	1,860	1,664	....	....
P1**	1,419	1,919	1,307	1,717	1,656	1,603	....	....
P2**	1,425	1,863	1,387	1,673	1,724	1,614	....	....
P3**	1,456	1,826	1,333	1,614	1,744	1,595	....	....
P4**	1,386	1,853	1,333	1,731	1,772	1,615	....	....

† During 1922 and 1923 we have only the records of the *average* yield of the three replications; in order to complete the table it is assumed that the yield was the same on the triplicates.

By comparing the final averages of each treatment (each representing fifteen trials) it is apparent that the differences are remarkably small. The greatest difference—comparing the highest with the lowest quantity of phosphorus—is only fifteen pounds and that *in favor of entire omission of phosphorus carriers.* This difference (about 1%) is too small to be significant. Thus we can safely conclude that the entire omission of phosphorus carriers for five years has not been attended by any decline in yield.

In order to answer the second question—relation of *quality* to phosphoric acid—the grade index was computed for each plot on the same basis for the years 1924, 1925 and 1926,† compared, and averaged in Table 4.

TABLE 4. FIELD TESTS AT WINDSOR. GRADE INDEX FOR 1924, 1925, 1926

Plot No.	Total Lbs. of P_2O_5 Applied in 5 Yrs.	1924	1925	1926	Average of 3 Yrs.	Average of 9 Replications
P1	995	.247	.472	.495	.405	.383
P2	331	.216	.478	.502	.399	.394
P3	770	.263	.422	.472	.386	.387
P4	1,398	.194	.427	.459	.360	.375
P1*	995	.241	.367	.483	.364	....
P2*	331	.247	.398	.539	.395	....
P3*	770	.258	.414	.493	.388	....
P4*	1,398	.269	.402	.508	.393	....
P1**	995	.252	.412	.473	.379	....
P2**	331	.266	.413	.483	.387	...
P3**	770	.249	.378	.501	.376	....
P4**	1,398	.243	.413	.460	.372	....

Comparison of the averages of the nine replications of each treatment show only small differences. The greatest difference is less than two cents a pound and this again is in favor of the *no-phosphorus plots. The high-phosphorus plots had the lowest* grade index. This corresponds with our observations during the sorting.

During the first year of this experiment, Chapman (26)‡ recorded the observation that the tobacco on the high-phosphorus plots had a distinct tendency to early ripening and the buds appeared fully a week before those on the other plots. This tendency was not evident during the succeeding four years. The writers watched for this carefully during the last two years but no such difference was observed. Certain objectionable colors were also observed in the tobacco from the high-phosphorus in

† Sorting data for the years 1922 and 1923 were not preserved in a form which admits of direct comparison with the data for the later years. However, it is probably preferable to confine the comparison to the later years of the experiment which reflects better the results of *continued* use of each treatment.

‡ Numbers in parentheses refer to bibliography on page 23 of this bulletin.

the early years but careful observation during the last two years failed to show this.

Conclusions. The effect of omitting all phosphorus carriers from the fertilizer ration has not been detrimental either to the yield or to the quality of the tobacco produced on this field. In fact there is some indication that both have been improved slightly. On the other hand the evidence that there has been a detrimental effect from the annual application of considerable quantities of phosphoric acid is not conclusive.

EFFECT OF RATE OF APPLICATION OF PHOSPHORUS ON THE BURN

Although no significant differences were noticed in the yield, grade index, or other points of quality which could be observed during the sorting, it was still conceivable that there might be some effect on the burn. Burn tests were therefore conducted in two ways on the samples from the twelve plots at Windsor after they had been fermented for two months in the force sweat room.

The first was a fire-holding capacity test on single leaves ignited with an electric match (cigar-lighter). From each plot, twenty individual tests were made on the seconds, light wrappers, medium wrappers and dark wrappers, making a total of 80 tests per plot or 240 tests for each treatment. The results are presented in Table 5. It will be observed from this table that the results are variable but certainly do not indicate a favorable influence from the high phosphorus. In fact the highest phosphorus plots have the lowest fire-holding capacity.

TABLE 5. RELATIVE FIRE-HOLDING CAPACITY. (ELECTRIC MATCH METHOD)

Plot No.	Lbs. P_2O_5 Per Acre	Average of 20 Tests in Seconds: Dark Wrappers	Medium Wrappers	Light Wrappers	Seconds	Average
P2	53	....	28.6	38.9	28.6	32.0
P2*	53	9.6	12.4	32.2	18.7	18.2
P2**	53	42.4	39.0	46.7	53.9	45.5
Ave.		26.0	26.6	39.2	33.7	32.0
P3	100	25.5	31.7	37.8	47.3	35.5
P3*	100	16.8	24.7	....	40.2	27.2
P3**	100	53.4	37.1	....	47.0	45.8
Ave.		31.9	31.2	37.8	44.8	36.1
P1	160	22.8	21.6	32.1	30.8	26.8
P1*	160	19.2	18.4	24.6	26.7	22.2
P1**	160	17.2	18.7	19.9	28.7	21.1
Ave.		19.7	19.6	25.5	28.7	23.3
P4	240	19.9	16.8	19.3	28.3	21.1
P4*	240	21.5	25.4	23.3	38.5	27.2
P4**	240	23.5	38.1	38.2	36.8	34.1
Ave.		21.6	26.7	26.9	34.5	27.5

In the second test, leaves from the fermented samples were used in making cigars. Some of the cigars from each plot were "clears," i. e., wrapper, binder and filler from the tobacco grown on that plot. Others had only the wrapper and binder from that plot put on a standard filler which was the same for all plots. All were smoked and records taken on the number of minutes during which they held fire when laid on the desk, the color and coherence of the ash and the evenness and closeness of burn.

The burn was satisfactory on all of them. In over one hundred tests and direct comparison, all held fire more than five minutes and none of them over nine, the ash was light to medium gray, the burn was even and fairly close and there were no consistent differences between the plots treated with different quantities of phosphorus.

In summary, we may say that the entire omission of special phosphorus carriers from the fertilizer mixture for five years has had no injurious influence on the burn of the tobacco.

Phosphorus Tests in Other Tobacco Sections

Since our tests show no response to phosphorus it will be instructive to compare with them the results of tests conducted along the same line in other tobacco sections.

Virginia. Concerning the flue cured tobacco districts of Virginia, Mathewson (24) says "Phosphoric acid may be considered the most generally needed plant food material throughout this tobacco growing region. It not only increases growth but hastens maturity and also strongly tends to brighten the color because of its decided effect in ripening the leaf." In experiments where tobacco was grown every fifth year in rotation and was the only crop to receive any fertilizer, Hutchison and Berger (15) found that "Of the single element carriers, acid phosphate gave the highest acre value." It was used at the rate of 700 lbs. per acre (112 lbs. P_2O_5). A 3-8-3 fertilizer is recommended for tobacco (5, 15) in Virginia.

Tennessee. In a ten year experiment on dark tobacco, starting with a field which was very low in productiveness, grown continuously the first three years and then in a three year rotation, Moores and Milton (25), speaking of acid phosphate, conclude that "The results of the first three years show a profitable increase from the 300 lb. rate, as compared with the 200 lb. rate. Four hundred pounds per acre was indicated to be of doubtful value over 300 pounds."

"Of the three rates of application under trial for seven years in the three year rotation of tobacco, wheat and clover and grass, 300 pounds per acre of acid phosphate produced both the largest and most profitable yields."

Ohio. Here also it was found (27) in the three year rotation with wheat and clover (when all the fertilizers were applied to tobacco) that "*when the phosphorus is increased to 720 lbs.* acid phosphate per acre, there is a marked gain in yield, this plot producing a greater total yield and a greater net gain than any one in the series." The value of manure was increased when phosphate was added to it. There was also an increase from phosphorus when tobacco was grown continuously. Selby and Houser state (33) that "In nearly all Ohio soils, phosphorus is the most deficient element, and until this element is supplied, the application of nitrogen or potassium produces but little or no effect." "Phosphorus when used alone on the typical upland soil of this region will produce a decided increase in the yield for several years, after which the production decreases, attended with decided marginal dying or drying up of the leaves. The bad effect on the quality of tobacco is entirely corrected by the addition of potash salts or nitrate of soda." They recommend 720 lbs. of acid phosphate per acre. In all of these Ohio experiments, fertilizer was applied only once in three years.

Canada. Experiments by the Dominion Department of Agriculture (4, 7, 8, 11, 34) on Burley, on Bright Flue Cured Tobacco, and on cigar leaf tobacco have shown improvement both in yield and quality by application of acid phosphate at the rate of 350-600 lbs. (56-96 P_2O_5) per acre. Freeman (11) writes "In all our experiments phosphorus in the form of acid phosphate has been shown to be needed on all tobacco soils and, until this is supplied, an application of nitrogen or potash produced little effect." Tobacco is grown in their system of agriculture only once in three or four years and is in rotation with general farm crops. Usually fertilizer is applied only to the tobacco.

Wisconsin. Johnson (16) says "It is believed that the average soil when set to tobacco in Wisconsin will respond quicker to phosphoric acid fertilizer than to any other." Later, Johnson and Slagg (17) write that "most of our tobacco soils respond to fertilization with phosphate fertilizers, and this element can profitably be applied alone or in combination with barnyard manure at the rate of 400-800 lbs. per acre in the form of acid phosphate." They recommend a 2-12-2 fertilizer.

Georgia. Experiments at the Georgia Coastal Plain Experiment Station show that (2) "Of the three plant foods, the absence of phosphoric acid resulted in the smallest growth, indicating that *this constituent is the first limiting factor of the soil of the Coastal* Plain."

Kentucky. Early experimenters (32) in Kentucky found that phosphorus was beneficial. Later work (29), however, in the Burley section does not show any significant response to phosphorus, since the yield differences between phosphorus and no

phosphorus plots are no greater than those between two adjacent untreated plots. Neither do other crops in the blue-grass section of Kentucky show a significant response to phosphorus.

Pennsylvania. Concerning the tobacco fertilizer experiments in Pennsylvania, Frear (10) says "The soil showed a marked need for phosphoric acid . . . this constituent cannot be safely omitted."

Maryland. Concerning early experiments on tobacco fertilizers in Maryland, Patterson (28) writes: "Phosphoric acid seemed to have but little direct bearing upon the combustibility, but generally produced a marked increase in the yield." In more recent and more extensive field tests, however, Garner and Brown (12) got no response whatever to phosphates. "In no instance," they write, "has any of the phosphates given a marked increase in yield and when the results are averaged for the six year period, there are no substantial differences in yield, either between the plots receiving the various phosphates or between these and the plots receiving no phosphate."

Summary. With two exceptions every fertilizer field test dealing with the phosphorus need of tobacco in the above mentioned tobacco growing states has shown a definite response to phosphate fertilizers. Why do we not get the same response in Connecticut?

1. In the other sections tobacco is not grown continuously but is rotated with crops which carry away considerable phosphorus.
2. Phosphorus is applied only once in the rotation, since the other crops are not fertilized.
3. The amount applied is very small compared with our heavy applications.
4. In some of these sections the soil contained a smaller supply of phosphorus before tobacco was grown.
5. The fertilizer mixture commonly used in other sections does not include organic substances containing phosphorus.

The two exceptions are readily explained. The soil in the Burley section of Kentucky is naturally very rich in phosphorus (see table 7). Garner and Brown explain the Maryland results on the grounds of (a) the cottonseed meal used in their mixture, (b) low phosphorus requirement of tobacco and (c) a phosphorus reserve in this particular soil.

The Role of Phosphorus in Plants

The early experiments on the functions of phosphorus and other essential elements were conducted either on poor, non-productive soils or in water and sand cultures. The physiological effects as stated in standard texts apply more directly to results obtained on low planes of nutrition. Field experiments, with acid phosphate or precipitated bone, have indicated that growth, earliness of maturity and seed production have been promoted by addition to

phosphorus-deficient soils. The greater number of these experiments have been on small grains and corn. With these crops, seed production is more important to the farmer than leaf growth. In the growing of tobacco, on the other hand, we are more directly concerned with vegetative growth than with seed production. Also, since the tobacco soils of Connecticut are managed on a high plane of fertility, it is doubtful if the conclusions derived from such experiments apply in the same way to tobacco in this section as grown under present day methods.

An adequate available supply of phosphoric acid is absolutely necessary for cell division and growth. It has been observed that algae (21) supplied with all the soil nutrients except phosphoric acid made no growth over a period of two months but algae supplied with it during the same interval doubled in size. The starved plants at the end of eight weeks when given a dose of available phosphoric acid showed energetic cell division.

Phosphorus is also necessary for protein formation. Not only do certain proteins contain phosphorus but Kraybill has found in tomato plants that "nitrate nitrogen is not available for protein synthesis even in the presence of an abundance of carbohydrates if phosphates are deficient." Phosphorus enters into the composition of the nucleus and plastids of the plant cells, and is identified in substances such as neucleoproteins, lecithin, chromatin and plastin.

The early growth of a seedling depends on phosphorus stored in the seed. At the time of blossoming and seed formation there is a rapid movement of phosphorus to the seed-producing portion of the plant. This may explain why seed crops such as the grains respond so well to phosphorus treatment. The quality of the grain is also improved because an added amount of phosphoric acid tends to increase the protein content. It may be stated that anything which promotes an absorption of phosphorus is accompanied by an increase in the protein content of the plant (35).

When there is a phosphorus deficiency, maturity is delayed and growth stops. Excessive amounts of available phosphoric acid produce symptoms of prematurity. On a tobacco plant this is made evident by so-called "firing." The leaves prematurely dry up from the bottom of the plant. This condition would naturally be more pronounced in a hot-dry than in a cool-wet season.

Since tobacco is primarily a leaf producing rather than a seed producing plant, the inference would be that it is not a high phosphorus requiring plant. This idea is further substantiated by chemical analyses showing the actual amount taken into the plant. In comparison with nitrogen, potash and calcium, the amount of phosphorus assimilated is very low.

Phosphoric Acid Content of Tobacco Leaves

Experiments by Jenkins (18) showed that tobacco absorbs from the soil relatively small amounts of phosphoric acid. The average analyses of tobacco taken from thirteen of his fertilizer plots showed that an 1800 pound crop (30% moisture) contained only 7.4 pounds. This gives an average of only .58% phosphoric acid on the basis of dry matter. The highest was .84% and the lowest .47%. In his work there is no correlation between the amount of phosphoric acid applied to the soil and the amount recovered in the leaf. Analyses on the phosphoric acid content of tobacco grown in other sections show about the same variation found in Connecticut. Kissling (19) has made an extensive review of analyses of the ash constitutents in tobacco leaves and shows variations between .49% and .70% with an average about the same as that determined by Jenkins.

As a further check on the effects of increasing amount of phosphoric acid applied to the soil in the fertilizer, analyses of samples taken from the crop of 1925 as reported by Dr. E. M. Bailey, chemist in charge of the analytical laboratory, New Haven, are given in Table 6.

Table 6. Phosphoric Acid Content of Tobacco Leaves on Basis of Air Dry Material, 1925 Crop

Lbs. P_2O_5 Applied Per Acre	% of P_2O_5 in 23" Darks on Triplicate Plots				% of P_2O_5 in 21" Lights on Triplicate Plots			
		*	**	Ave.		*	**	Ave.
53	.64	.82	.89	.78	.56	.64	.65	.62
100	.64	.74	.77	.72	.66	.70	.54	.63
160	.82	.78	.88	.83	.57	.68	.70	.65
250	.64	.73	.73	.70	.61	.69	.54	.61

The results of the above analyses show that there is no consistent relation between the amount of phosphoric acid applied to the soil and the phosphoric acid content of the leaf. The darks, however, consistently had a higher phosphoric acid content than the lights.

The Functions of the Phosphorus Constituent of a Fertilizer

The primary value of the phosphoric acid contained in a fertilizer can be properly ascribed to its direct effect of supplying an adequate amount of available phosphorus when the soil is unable to furnish it. On soils containing a very small amount of available phosphorus before fertilization, the growing plant must depend almost entirely upon the fertilizer for a supply of phosphorus which can be absorbed in suitable amount during the

period when it is demanded. Vast areas of crop land in eastern United States have been inadequately fertilized with respect to phosphorus, and contain relatively small total amounts of this element. On such land, phosphatic fertilizers have produced great increases in crop, and the high response to phosphorus relative to that of nitrogen and potassium on field crops has been to a great measure responsible for the popularity of 2-12-2, 4-8-4 and similar ratios of nitrogen, phosphoric acid and potash.

But when the soil is well supplied with phosphorus in an available form, the value of fertilizers supplying phosphorus can be expected to produce relatively less direct benefit. Phosphorus fertilization shows remarkable returns on soils which are seriously deficient in an available supply of this element, but when there is a high natural supply or a considerable accumulation of the residues of previous phosphate applications, the soil may be in such condition that the additional amount of phosphorus supplied in the fertilizer may produce little or no effect.

Phosphorus fertilization may produce indirect effects of great importance. Chief of these is probably the benefits to the essential soil micro-organisms. But here, too, we are dealing with conditions where the phosphorus supply and availability must be taken into account. It is on the soil which liberates an inadequate amount of phosphorus for crop growth that the activities of micro-organisms might be impaired, since phosphorus is essential to their proper development.

Another outstanding indirect effect of phosphorus fertilization is its function on strongly acid soils, which contain considerable amounts of soluble aluminum, toxic to the growth of many plants. Hartwel and his co-workers (14, 3), as well as several other investigators, have shown quite conclusively that large quantities of phosphate, much in excess of the probable demands of the crop for plant food material, can produce great increases in crop through its action in precipitating the injurious soluble aluminum out of the soil solution. Under such conditions the same result can be brought about by lime, and it is questionable whether phosphorus fertilization primarily for the correction of the injurious effects of acid soil conditions will ever prove desirable.

The Supply and Availability of Phosphorus in Connecticut Tobacco Soils

In their natural unfertilized condition, the total supply of phosphorus in the soils of the Connecticut tobacco district probably ranges from 1,000 to 2,000 pounds of phosphorus (equivalent to 2,300 to 4,600 pounds of phosphoric acid) per acre within average plow depth. To investigate the cumulative effect of tobacco fertilization, a series of 68 soils from the tobacco section were ana-

lyzed for total and "available" phosphorus. Twenty-one of these soils, from fields either never in tobacco or less than 5 years in that crop ("new land") showed an average of 1,528 pounds of total phosphorus, with an average deviation of 281 pounds above or below this amount. Twenty-seven soils, in tobacco for from 5 to

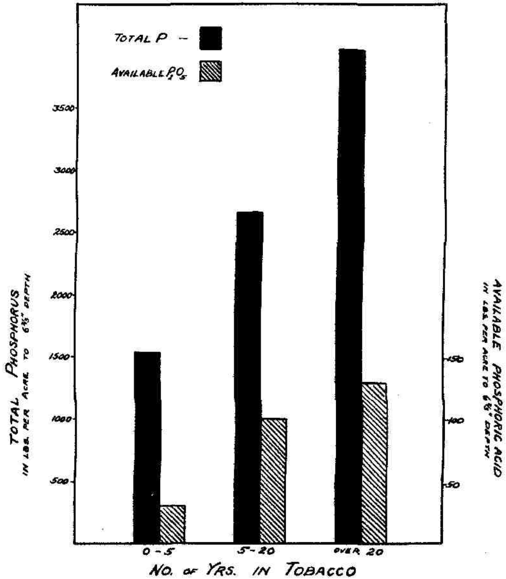

FIG. 1. The accumulation of phosphorus in heavily fertilized tobacco soils in Connecticut.

20 years, averaged 2,655 pounds (± 538 lbs.), 20 soils, in tobacco 20 or more years, averaged 3,855 pounds (± 566 lbs.). This is shown graphically in Figure 1.

The above very strikingly shows the rapid accumulation of phosphorus with the tobacco fertilization practice usually followed in Connecticut. Thus in less than 20 years the phosphorus con-

tent of the soil is built up to almost twice the original amount, and rapidly exceeds this with increasing years of fertilization. This result, while perhaps not anticipated, is not difficult to explain. If we assume the complete removal of both stalks and leaves of an 1,800 pound crop of tobacco, not more than 15 pounds of phosphoric acid is removed per year. The average fertilization is at least 150 pounds of phosphoric acid. There remains 135 pounds phosphoric acid, equivalent to about 60 pounds of phosphorus. Thus a soil originally containing 1,500 pounds of phosphorus could be built up to 3,000 pounds in twenty-five years of continuous fertilization.

Besides the fertilizer, other materials which contain phosphorus are added to the soil. A ton of tobacco stalks or stems contains at least 13 pounds of phosphoric acid (5.7 lbs. phosphorus). Ten tons of manure contains probably 50 pounds of phosphoric acid (about 22 lbs. phosphorus).

How much of the phosphorus which is not taken up by the crop is lost from the soil through leaching? Experiments at Rothamsted (20) and Cornell (22, 23) and at the Florida Station (6) have shown that the loss of phosphorus in this manner is practically nil. There is a lack of evidence on this point where heavy fertilization is applied to sandy soils, though Fraps (9) has shown that there is a possibility of a small loss under such conditions. Several samples of drainage water collected during the first year of an experimental type of lysimeter at Windsor has shown a concentration of 2 to 3 parts per million of P_2O_5, and if such a concentration is maintained throughout the year, this represents a possible loss of around 5 pounds of phosphorus (11.5 lbs. phosphoric acid) per acre per year. It is hoped that further evidence on this point will be obtained during the next two or three years.

The total phosphorus to be found in an old tobacco soil represents a rather high amount as compared with other soils of the country. A comparison is shown in Table 7.

TABLE 7. TOTAL PHOSPHORUS CONTENT OF SOME SOILS IN EASTERN UNITED STATES

State	Remarks	Total Phosphorus in Lbs. Per Acre to 6 2/3 in. Depth
Connecticut	Tobacco fields over 5 years in tobacco, 48 soils	3,260
	Tilled areas in general farm crops, never in tobacco, 58 soils	1,858
	Pasture fields, 52 soils	1,540
New Jersey	Types similar to Connecticut, 14 soils	1,452
New York	Average loam	1,480
Ohio	Average of 126 soils	1,125
West Virginia	Average of 485 soils	1,040
Illinois	Light colored silt loams	1,200
	Heavy black prairie soils	2,000
Kentucky	"Blue grass" soils	9,000

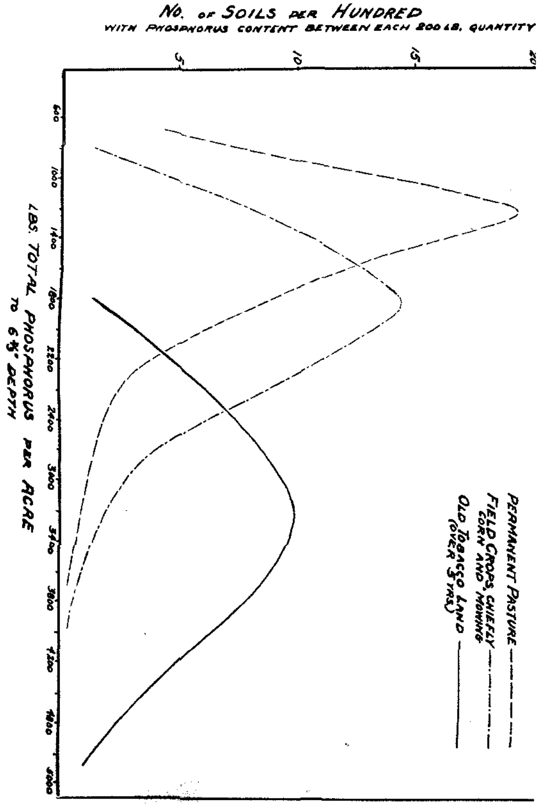

FIG. 2. The distribution of total phosphorus content in old tobacco soi as compared with other soils of Connecticut.

The distribution of total phosphorus in old tobacco soils in comparison with soils under other systems of management is shown graphically in Figure 2.

Since the residual effect of several years of tobacco fertilization at the rate of 150 to 200 pounds of phosphoric acid is sufficient to build up the soil to a relatively high total phosphorus content, one naturally asks if this accumulation is sufficiently available to provide subsequent crops with all the phosphorus they require for adequate yield and quality. The only absolute answer is found through trials such as have been made at Windsor during the last five years to ascertain whether or not there is a response to continued use of phosphatic fertilizers. The result on this particular field has shown conclusively that applications of phosphate in excess of that furnished by the organic ammoniates are no longer required.

Chemical tests of the availability of the soil phosphorus while furnishing us with valuable indications along this line must always be arbitrary in character. Phosphorus available for one species of plant may not be so for another, and the same amount of chemically "available" phosphorus may be easily obtained by the crop on a certain soil, and with difficulty on a different one. Such tests of Connecticut soils have shown that on the old tobacco fields there is a relatively high amount of phosphorus which is soluble in carbonated water and very dilute acids, of similar concentration to the soil solution. The following figures are significant:

> 21 soils, never in tobacco or less than 2 years in tobacco (new land) average *30 lbs.* phosphoric acid per acre soluble in dilute (N/100) sulfuric acid, ranging from 10 to 60 lbs.
> 20 soils, 5 to 20 years in tobacco average *100 lbs.* "available" phosphoric acid per acre, ranging from 70 to 140 lbs.
> 21 soils, over 20 years in tobacco, average *130 lbs.* "available" phosphoric acid per acre, ranging from 90 to 160 lbs.
> This is also shown graphically in Figure 1.

The plots at Windsor upon which no response for phosphorus is obtained range from 100 to 160 pounds "available" phosphoric acid by this test.

In a series of plot experiments on different soils at New Haven, growing alfalfa, soils which show less than 60 pounds of "available" phosphorus have shown decided crop increases from phosphatic fertilizers, while an old tobacco soil in these trials, with 90 pounds of "available" phosphoric acid, showed no increased growth when phosphorus was applied, although it responded to both lime and potash. Alfalfa is a crop which is very sensitive to deficiencies of phosphorus.

The residual phosphorus from fertilizers in which precipitated

bone is the principal phosphorus carrier, while reverting ver quickly to less soluble forms, remains absorbed in the soil in a condition from which it is much more easily liberated than th native phosphorus in the original soil, which is probably chiefl composed of particles of mineral phosphate (apatite) (13, 36) A considerable amount of this residual phosphorus may be i organic compounds (30) from the residues of tobacco roots an stalks and of the organic ammoniates applied. Much of suc phosphorus is easily broken down into forms which are readil available to the plant (31).

Summary

Field plot tests over a period of five years on old tobacco lan at Windsor show that tobacco is indifferent to the quantity o phosphorus used in the fertilizer. No significant difference could be found in the yield or quality of tobacco irrespective o quantity of phosphorus in the fertilizer.

Extensive burn tests failed to show that the burn was affecte by the rate of application of phosphorus in the fertilizer.

These results are different from those secured from fertilize tests in other tobacco-growing sections of the country. Of th numerous field tests reported in other states, only two fail to show definite favorable response from phosphorus application.

This difference in response between Connecticut soils and tha in other sections is due to long continued heavy applications o phosphates which have built up an immense surplus more tha adequate to supply the needs of the crop.

When additional phosphorus is added to old tobacco soils it i not taken up by the plant. Analyses of tobacco from the differen plots showed that there was no correlation between the quantity of phosphorus in the leaves and that applied to the soil.

Very little of the phosphorus is removed by the plant (6½ lbs per acre) and only a very small quantity is lost by leaching Neither is it forever lost by forming unavailable combination with the soil constituents. Analyses show that these old soils ar well supplied with available as well as total phosphorus.

Special carriers of phosphorus could probably be omitted from the fertilizer mixture for an indefinite period of years withou harm to the tobacco crop on fields where this crop has been grown continuously. The organic constituents alone in the ordinary tobacco mixture supply four times as much phosphorus as the plant needs. This alone should guard against depletion.

No secondary benefits from phosphorus (as a soil correctant) have been observed in these experiments. The corrective action

well, if not

New Tobacco Fields

Although the great bulk of tobacco is raised where tobacco has been grown more or less continuously for many years, there are always some new fields which have not been previously cropped to tobacco or have grown tobacco for a short time. Unless previous crops on this land are known to have received considerable phosphates, it would seem advisable to apply considerable phosphorus in the fertilizer. We suggest about 160 pounds of phosphoric acid per acre. Up to the present we have not had any new land available for experimental work along this line, but it is hoped that this may be started in 1927.

By reference to Table 8 the grower who wishes to mix a fertilizer for new land may compute the quantity of carrier needed. This table of analyses was kindly prepared by Dr. E. M. Bailey of the Chemistry Department of this station and includes most of the materials containing phophorus which have been used on tobacco fields. Some of them are used for their phosphorus alone, while others contain other plant foods. Some which are used primarily as nitrogen carriers also contain some phosphorus. For this reason we have included all which contain more than a trace of phosphorus and have given also the percentage of nitrogen and potash as well as some other elements which are of interest to the tobacco grower.

TABLE 8. AVERAGE OR TYPICAL ANALYSES OF TOBACCO FERTILIZER MATERIALS CONTAINING PHOSPHORUS

Name	Phos. Acid				Potash					
	Total P_2O_5	"Avail." P_2O_5	Nitrogen (N)	Ammonia (NH_3)	Total K_2O	Water-Sol. K_2O	Chlorine (Cl)	Lime (CaO)	Magnesia (MgO)	Sulf. Acid (SO_3)
	%	%	%	%	%	%	%	%	%	%
Precipitate bone	38.3	37.7	....	....	....	....	....	45.3[1]	....	....
Bone meal	24.0	([2])	3.1	3.8	....	....	0.3	28.4[1]	....	....
Steamed bone	28.0	([2])	1.5	1.8	....	....	0.3	33.6[1]	....	....
Acid phosphate	17.2	16.0	....	....	....	....	....	20.4[1]	....	....
Rock phosphate	32.0	([3])	....	....	....	....	....	37.9[1]	....	....
Ammo-phosphate	22.3	21.7	16.4	10.9	....	....	trace	....	....	....
Dry ground fish	7.6	([5])	8.7	10.6	1.1	....	0.3	8.7	0.4	5.2
Tankage, high grade	9.2	([2])	7.6	9.2	....	....	0.4	11.0[1]	....	....
low grade	20.2	([2])	4.2	5.1	....	....	0.4	24.2[1]	....	....
Wood ashes	2.1	....	....	....	....	6.6	0.5	36.6	5.7	1.2
Cottonhull ashes	9.8	8.0	....	....	....	25.0	0.2	5.2	11.2	2.4
Tobacco stems	0.5[6]	....	2.1[6]	2.6	6.4[6]	....	0.5	3.8	0.5	0.5
Cottonseed meal	2.9	....	6.8	8.3	1.9	....	trace	0.3	0.7	....
Linseed meal	1.7	....	6.0	7.3	1.3	....	none	....	....	....
Castor pomace	2.2	....	5.0	6.1	....	....	0.1	0.9	0.8	....
Cow manure[7]	0.3	....	0.4	0.5	0.5	....	0.1	0.2	0.1	0.1
Horse manure[8]	0.4	....	0.7	0.9	0.6	....	0.1	0.5	0.2	0.1
Sheep manure	1.5	1.3	2.1	2.6	....	2.4	....	....	....	....

[1] Based on the calcium equivalent to phosphoric acid.
[2] Approximately ½ "available."
[3] From 1 to 2 per cent "available."
[5] About 5 per cent "available."
[6] Average of 50 analyses.
[7] Wet, 72 per cent water.
[8] Wet, 66 per cent water.

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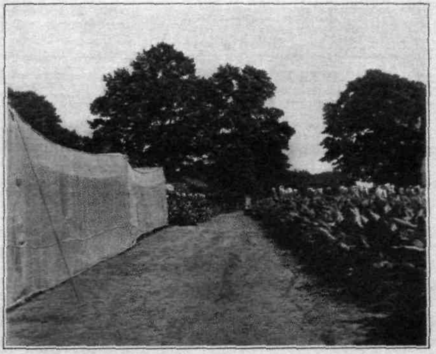
Connecticut Agricultural Experiment Station

New Haven, Connecticut



LOOKING SOUTH BETWEEN SHADE AND HAVANA BREEDING PLOTS.

REPORT OF TOBACCO STATION AT WINDSOR

1926

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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Report of Tobacco Station—1926

P. J. Anderson[1] and N. T. Nelson[2]

This report represents a continuation of the policy established last year of annually reporting progress in research work on tobacco. On some of the projects this is the final statement, but on most of them it is a report of progress; a presentation of the data obtained without drawing final conclusions. It is our purpose to publish a separate bulletin on each phase of the work as soon as sufficient new information on that line has been accumulated to warrant it. In accord with this policy three bulletins from the tobacco station are now in press as follows:

"Phosphorus Requirements of Old Tobacco Soils"
"Chemical Preservation of Tobacco Shade Tent Poles"
"Influence of Height and Stage of Topping on the Quality and Yield of Cigar Leaf Tobacco"

These lines of work are not discussed in this report. Limitation of space also makes it advisable to postpone discussion on some of the other projects listed below, in order to cover more fully those which are complete or well along.

The projects which have been actively carried forward in 1926 are as follows:

1. Fertilizer experiments.
   The old nitrogen series. Fifth year. Final report and summary in this bulletin.
   Synthetic urea as a sourse of nitrogen. Second year. All experiments to date described here.
   The phosphoric acid series. Fifth year. Fully treated in Tobacco Bulletin No. 7.
   The old potash series. Fourth year. Fully discussed to date below.
   Muriate of potash. Discussed in full here.
   Carbonate and nitrate of potash. Data on current year presented.
   Sulfur, magnesia, chlorine series. (In coöperation with U. S. Dept. of Agriculture.)
   Fractional application series. Not discussed at this time.
   Manure series. Not discussed.
2. Strain tests.
   Havana seed strains. Third year. Fully discussed below.
   Broadleaf strains. Third year. Discussed below.

[1] In charge, Tobacco Station.
[2] Plant Physiologist, Tobacco Station.

3. IMPROVEMENT OF SHADE TOBACCO BY BREEDING AND SELECTION. No report.
4. COVER CROPS FOR TOBACCO. Report later.
5. BROWN ROOTROT EXPERIMENTS. Second year. Not reported
6. RELATION OF SOIL REACTION TO BLACK ROOTROT AND OPTIMUM GROWTH OF TOBACCO. Discussed briefly below.
9. TESTS OF CHEMICALLY TREATED SHADE CLOTH. Discussed fully here.
10. THE ROLE OF HUMIDITY AND TEMPERATURE IN CURING. Not discussed.
12. TOPPING AND SUCKERING EXPERIMENTS. Published in separate bulletin.
14. CONTROL OF WIREWORM. Progress report below.
15. MISCELLANEOUS TOBACCO DISEASES. Notes below.

FERTILIZER EXPERIMENTS

THE OLD NITROGEN SERIES

This series has now been continued for five years. All fertilizer treatments in 1926 were the same as for the 1925 crop except that the precipitated bone was omitted because this field has shown no need of phosphoric acid.[1] The twenty-one plots, each of one fortieth acre, are on Field 1 of the station farm which is a sandy loam of the Merrimac series and has always grown good tobacco. The field is fairly uniform but a survey by the Soils Department showed some inequalities. In order to overcome any differences in productiveness due to these irregularities, the triplicate groups of seven plots each were located on different parts of the field.

The objects of this series were to compare the yield and quality of Havana Seed Tobacco when:

1. One-fifth of the nitrogen is supplied in mineral carriers.
2. One-half the nitrogen in mineral carriers.
3. None of the nitrogen in mineral carriers.
4. One-half the nitrogen in dry round fish.
5. One-half the nitrogen in high grade tankage.

The other carriers of nitrogen are cotton seed meal and castor pomace, which are considered standard.

In 1926 the fertilizer was applied to all on May 22d and the plants set on June 4th. All were harvested on August 16th. No significant differences in growth were noticed throughout the season. The early part of the growing season was dry and cold but the growth was fairly satisfactory. Long continued rainy periods during the harvesting and curing season, however, resulted in a rather poor cure with some pole-sweat. All the tobacco from these plots was sorted by experienced sorters in the station ware-

[1] See Tobacco Bulletins 5 and 6 for a more detailed description of this series and reports of results of the first four years.

house. The yield per acre, variation, percentages of grades and the grade index* for the various plots are presented in Table 1.

(L) Light wrappers	1.00	(LD) Long darks (19" up)	.30
(M) Medium wrappers ..	.60	(DS) Dark stemming (17")	.20
(LS) Long sec. (19" up)	.60	(F) Fillers	.10
(SS) Short sec. (15 & 17")	.30	(Br) Brokes	.10

The grade index of any plot is obtained by multiplying the percentage of each grade by the price in above schedule and adding the products.

TABLE 1. OLD NITROGEN SERIES, 1926. ACRE YIELDS AND PERCENTAGE OF GRADES.

Plot No.	Nitrogen treatment	Acre yield	% variation†	Percentage of grades: L	M	LS	SS	LD	DS	Fil	Br	Grade index
N1	⅕ N in nitr. soda	1760	0	12	6	26	4	40	1	10	1	.457
N2	½ N in nitr. soda	1730	—2	11	9	32	4	34	1	8	1	.481
N3	⅕ N in sulf. am.	1668	+1	9	12	31	1	38	0	7	2	.474
N4	½ N in sulf. am.	1715	—3	10	12	23	1	42	1	9	2	.452
N5	All N in organics	1743	—1	13	11	22	2	42	0	9	1	.470
N6	½ N in fish	1827	+4	7	9	33	2	39	0	9	1	.455
N7	½ N in tankage	1737	—2	13	8	26	2	41	0	9	1	.473
N1*	⅕ N in nitr. soda	1759	—2	18	14	24	3	30	1	9	1	.519
N2*	½ N in nitr. soda	1765	—2	15	12	24	3	36	1	8	1	.494
N3*	⅕ N in sulf. am.	1860	+3	11	9	27	2	41	1	10	1	.468
N4*	½ N in sulf. am.	1762	—2	10	7	24	2	45	1	10	1	.440
N5*	All N in organics	1872	+4	9	5	31	2	43	0	9	1	.451
N6*	½ N in fish	1825	+2	10	5	30	1	44	0	9	1	.455
N7*	½ N in tankage	1744	—3	15	6	29	1	38	1	9	1	.489
N1**	⅕ N in nitr. soda	1932	—1	25	16	14	5	31	1	7	1	.548
N2**	½ N in nitr. soda	1889	—3	25	17	13	4	31	1	8	1	.546
N3**	⅕ N in sulf. am.	1940	0	23	9	20	3	33	2	9	1	.526
N4**	½ N in sulf. am.	1973	+1	17	8	20	3	43	0	8	1	.485
N5**	All N in organics	1961	+1	15	9	21	2	43	0	9	1	.475
N6**	½ N in fish	1994	+2	23	12	14	3	40	0	7	1	.523
N7**	½ N in tankage	1941	0	31	16	14	4	27	0	7	1	.591

* First replication.

** Second replication.

† Percentage of variation from the average of the group of seven in which it lies.

Since this series of plots has now been continued for five years and will be discontinued in 1927, the results obtained can now be

* *The grade Index.* In comparing the quality of tobacco grown on different plots it is very difficult to keep in mind the percentage of six to eight commercial grades of tobacco from one plot and compare with a like number from another. To simplify these comparisons a grade index was devised. The grade index is a *single number* expressing *the* quality of *all* the tobacco grown on a particular plot. It is based on the percentage of carefully assorted commercial grades and the relative price value of the different grades. Although market prices vary from year to year, it was found, after consultation with experienced dealers, that the ratios of prices between the different grades are fairly constant. These adopted *price relationships for the different grades are as follows:*

summarized. In Table 2 the acre yields of all plots for the five years are recorded and summarized. Since there were some changes in the treatment beginning with 1925 (explained in Bul. 6, p. 6) the results for the first three years are averaged, then those of the last two and finally those for all five years (except for N3, N4 and N5 on which the change in treatment was so great as to make the results not comparable during the two periods). The grade indices for 1925 and 1926 are compared in Table 3. Indices for the first three years are not included because the sorting data were not recorded in a form suitable for computing indices on the same basis as for the other years.

TABLE 2. NITROGEN PLOTS. ACRE YIELDS, IN POUNDS, FOR FIVE YEARS

Plot No.	Nitrogen treatment	Acre yield 1922	1923	1924	1925	1926	Five year ave.	2 yr. 1925-1926	3 yr. 1922-1924
N1	⅕ N in nitr. soda	1396	1768	1307	1814	1760	1609	1787	1490
N2	½ N in nitr. soda	1204	1795	1360	1729	1730	1564	1730	1453
N3	⅕ N in sulf. am.	1456	1857	1387	1681	1668	....	1674	1633
N4	½ N in sulf. am.	1360	1789	1333	1747	1715	....	1731	1494
N5	All N in organics	1460	1955	1280	1709	1743	....	1726	1565
N6	½ N in fish	1382	1927	1440	1993	1827	1714	1910	1583
N7	½ N in tankage	1280	1919	1413	1771	1737	1624	1754	1537
N1*	⅕ N in nitr. soda	1396	1768	1387	1787	1759	1619	1773	1517
N2*	½ N in nitr. soda	1204	1795	1307	1844	1765	1583	1804	1435
N3*	⅕ N in sulf. am.	1456	1857	1440	1975	1860	....	1917	1584
N4*	½ N in sulf. am.	1360	1789	1440	1945	1762	....	1854	1529
N5*	All N in organics	1460	1955	1360	1863	1872	....	1868	1592
N6*	½ N in fish	1382	1927	1413	1826	1825	1675	1825	1574
N7*	½ N in tankage	1280	1919	1440	1879	1744	1652	1811	1549
N1**	⅕ N in nitr. soda	1396	1768	1493	1914	1932	1701	1923	1556
N2**	½ N in nitr. soda	1204	1795	1387	1851	1889	1625	1870	1462
N3**	⅕ N in sulf. am.	1456	1857	1387	1778	1940	....	1859	1567
N4**	½ N in sulf. am.	1360	1789	1467	2047	1973	....	2010	1539
N5**	All N in organics	1460	1955	1360	1884	1961	....	1922	1592
N6**	½ N in fish	1382	1927	1360	1857	1994	1704	1925	1556
N7**	½ N in tankage	1280	1919	1440	1888	1941	1694	1915	1546

SUMMARY OF TABLE 2. AVERAGE OF ALL PLOTS TREATED ALIKE.

Plot No.	Nitrogen treatment	Five years	Two years 1925-1926	Three years 1922-1924
N1	⅕ N in nitr. soda	1643	1828	1521
N2	½ N in nitr. soda	1591	1801	1450
N3	⅕ N in sulf. am.	....	1817	1576
N4	½ N in sulf. am.	....	1865	1521
N5	All N in organics	....	1839	1583
N6	½ N in fish	1698	1887	1571
N7	½ N in tankage	1657	1827	1544

TABLE 3. NITROGEN TREATMENT. GRADE INDEX FOR 1925-1926.

Plot No.	Nitrogen treatment	Grade index 1925	1926	Ave.	Ave. of 6 rep.
N1	1/5 N in nitr. soda	.427	.457	.442	.468
N2	1/2 N in nitr. soda	.420	.481	.450	.468
N3	1/5 N in sulf. am.	.431	.474	.452	.459
N4	1/2 N in sulf. am.	.422	.452	.437	.428
N5	All N in organics	.399	.470	.434	.426
N6	1/2 N in fish	.399	.455	.427	.448
N7	1/2 N in tankage	.460	.472	.466	.473
N1*	1/5 N in nitr. soda	.439	.519	.479	....
N2*	1/2 N in nitr. soda	.413	.494	.453	....
N3*	1/5 N in sulf. am.	.451	.468	.459	....
N4*	1/2 N in sulf. am.	.381	.440	.411	....
N5*	All N in organics	.373	.451	.411	....
N6*	1/2 N in fish	.397	.455	.426	....
N7*	1/2 N in tankage	.395	.489	.442	....
N1**	1/5 N in nitr. soda	.418	.548	.483	....
N2**	1/2 N in nitr. soda	.459	.546	.502	....
N3**	1/5 N in sulf. am.	.408	.526	.467	....
N4**	1/2 N in sulf. am.	.387	.485	.436	....
N5**	All N in organics	.389	.475	.432	....
N6**	1/2 N in fish	.462	.523	.492	....
N7**	1/2 N in tankage	.431	.591	.511	....

The following summary of results is based on the data accumulated for five years presented in the tables, our own observations, numerous burn tests (to be recorded in a later report) and the judgment of tobacco experts.

Effect of increasing the amount of nitrate of soda (N1 and N2 plots). In the N1 plots, *one-fifth* of the nitrogen is in the mineral carrier nitrate of soda while in the N2 plots *one-half* of the nitrogen is from nitrate of soda. By reducing thus the quantity of the more expensive organic nitrogen carriers and increasing the mineral carriers a saving of approximately $10.00 per acre is effected. What has been the effect on the quality and on the yield? Since during the first three years one-half of the mineral nitrogen was from sulfate of ammonia, we should probably compare only the figures for 1925 and 1926. During these years the N1 plots produced an average of 27 lbs. per acre more than the N2 plots. The grade index was exactly the same, .468. Multiplied by 27 this gives a difference of $12.64 in favor of the N1 plots which compensates for the $10.00 which was saved on the fertilizer. If we disregard the slight change in formula during the first three years and compare the average yields of 15 replications for each, there is a difference of 52 lbs. in favor of the N1 plots or a difference of 71 annually during the first three years.

Conclusions from the five years' tests. There has been no bad effects on the quality of the tobacco from increasing the nitrate of soda. There has, however, been a slight reduction in yield which approximately compensates for the saving in cost of fertilizer. In case the organic fertilizers become more expensive

and the mineral carriers less expensive (a tendency which may he anticipated) there seems to be no good reason why nitrate of soda cannot be used in larger quantities to replace the organics.

Comparison of nitrate of soda with sulfate of ammonia as a source of one-fifth of the nitrogen (N1 and N3 plots). The formula for the N3 plots was the same during the last two years as for the N1 plots except that sulfate of ammonia was used on the N3 plots. The average yield of six replications during these two years was 11 pounds per acre less on the sulfate of ammonia plots than on the nitrate of soda plots. The grade index was also lower, indicating that the quality was not quite as good. Notes taken at the time of sorting and burn tests also confirm the latter statement. The high percentage of sulfur in sulfate of ammonia makes it a less desirable source of nitrogen than nitrate of soda.

Conclusion. Nitrate of soda seems preferable to sulfate of ammonia to supply one-fifth of the nitrogen in the fertilizer formula.

Comparison of nitrate of soda with sulfate of ammonia as a source of one-half of the nitrogen (N2 and N4). This comparison was made only during 1925 and 1926. Averages of six replications of each during those two years show a gain in yield of 64 pounds by the use of sulfate of ammonia. It will be noticed, however, that the grade index for the sulfate of ammonia was the next lowest of all the plots. During both years the percentage of dark leaves was higher on these plots than for any other treatment. The quality at time of sorting was rated as low as any. There was considerable white and prominent vein. When burn tests were made, these plots rated the lowest of any in fire-holding capacity and color of ash.

Conclusions. Sulfate of ammonia keeps up the yield but produces tobacco of poor quality and poor burn.

All nitrogen from organic carriers compared with one-fifth of the nitrogen from mineral sources (N1 and N5 plots). The average yield of the six tests of each was nearly the same but the average grade index was lower for the organic plots. The tobacco on the latter plots was better during the second than during the first year.

Conclusions. Although the data are not entirely convincing we may at least conclude that no harm has come from supplying one-fifth of the nitrogen from nitrate of soda and there has certainly been no advantage in supplying it all from organic carriers.

One-half of the nitrogen from dry ground fish (N1 and N6 plots). Except for a small reduction in total quantity of fertilizer at the beginning of the fourth year (Bul. 6, p. 6) the treatment of these plots has remained the same throughout the five years of the experiment. We therefore have 15 replications of each. The average yield of these fifteen replications has been 55 pounds

higher for fish plots. In fact the yield was the highest of any in the nitrogen series. The average grade index, however, has been somewhat higher for the plots in which there was no fish.

Conclusions. The fire-holding capacity was considerably lower in the fish plots. Apparently excessive use of fish has impaired the fire-holding capacity. Also the ash was not as white on the fish plots.

One-half the nitrogen from high grade tankage (N1 and N7 plots). The treatment of these plots also has remained practically unchanged during the five years. The average yield for the fifteen replications has been 14 pounds per acre higher for the tankage plots than for the N1 plots. The grade index is also slightly higher on the tankage plots. In the burn tests, the fire-holding capacity has been practically as good as for the N1 plots. The ash color has not been quite as good as for the N1 plots. No difference in aroma or other burn characters were observed.

Conclusions. In every other respect except a somewhat darker ash, the tobacco from the tankage plots has been just as good as, if not a little superior to, that from the N1 plots throughout the five years. Although we would not advocate the use of tankage as the only source of nitrogen, the very favorable results certainly indicate that it could be used more extensively to replace cottonseed meal than it has been, especially during years when cottonseed is high. The principal advantage in using tankage is its relatively low cost. The following information concerning tankage has been furnished by Dr. E. M. Bailey of the Chemistry Department:

For the last five years, the average price for nitrogen in tankage has been 26¢ per pound. During the same period the price for nitrogen in cottonseed meal has been 34½¢ per pound. Tankage comes from meat and bone refuse from slaughter houses and the nitrogen and phosphorus content varies according to the amount of bone included (bone raising the percentage of phosphorus). Low grade tankage contains less than 5% nitrogen and over 15% of phosphoric acid. High grade contains more than 5% nitrogen. Average analyses of the two for the five years shows the percentage of nitrogen in cottonseed meal and tankage to be about the same. Other ingredients found in tankage according to analyses made for the tobacco station are 5.1% calcium oxide, 0.29% magnesium oxide, 2.6% sulfate and 0.31% chlorine.

SYNTHETIC UREA AS A SOURCE OF NITROGEN

Synthetic urea and other forms of air nitrogen compounds give promise of becoming the cheapest and most plentiful source of fertilizer nitrogen. If they can be used to advantage they are certainly the most economical carriers of nitrogen on the market. Tests were started in 1925 on six one-fiftieth acre plots on Field X of the Tobacco Station farm. The plan of the experiment

was to compare the yield and quality of Havana seed tobacco when the nitrogen of the fertilizer mixture was:

1. All from urea.
2. One-half from urea (other half from cottonseed meal and castor pomace).
3. None from urea (standard formula).

The composition of the fertilizer mixtures is given below:

Plot N1. Standard formula. No urea.

Carrier name	Lbs. per acre	Cost an acre	Lbs. plant nutrient per acre NH_3	P_2O_5	K_2O	MgO
Cottonseed meal	1,463.4	$36.59	120	42.4	21.9	10.2
Castor pomace	588.2	8.82	40	10.6	5.9	4.7
Nitrate of soda	212.7	7.23	40	....	....	....
Precipitated bone	277.9	8.34	....	107.0	....	....
Sulfate of potash	172.2	4.74	....	....	86.1	....
Carbonate of potash	132.2	9.94	....	....	86.1	....
Total	2,846.9	$75.66	200	160.0	200.0	14.9

Plot N8. 1/2 ammonia in synthetic urea.

Carrier name	Lbs. per acre	Cost an acre	Lbs. plant nutrient per acre NH_3	P_2O_5	K_2O	MgO
Cottonseed meal	914.6	$22.87	75	26.5	13.7	6.4
Castor pomace	367.7	5.52	25	6.6	3.7	2.9
Urea	178.4	13.38	100	....	....	....
Precipitated bone	329.6	9.89	....	126.9	....	....
Sulfate of potash	172.0	4.73	....	....	86.0	....
Carbonate of potash	132.3	9.92	....	....	86.0	....
Double sulfate	40.7	.71	....	....	10.6	4.6
Total	2,135.3	$67.02	200	160.0	200.0	14.9

Plot N9. All ammonia in synthetic urea.

Carrier name	Lbs. per acre	Cost an acre	Lbs. plant nutrient per acre NH_3	P_2O_5	K_2O	MgO
Urea	357.0	$26.78	200	....	....	....
Precipitated bone	415.5	12.47	....	160.0	....	....
Sulfate of potash	165.8	4.60	....	....	82.9	....
Carbonate of potash	127.4	9.55	....	....	82.8	....
Double sulfate	131.8	2.31	....	....	34.3	14.9
Total	1,197.5	$55.70	200	160.0	200.0	14.9

Thus by using the N8 formula the cost of the fertilizer would be reduced $8.64, while by using the N9 formula it would be reduced $19.96 per acre.

The fertilizer was applied May 26 and the plants set June 14, 1926. All plots were identical as to location and treatment in 1925 and 1926. The growth of the tobacco was not uniform but the poor spots showed no relation to the fertilizer treatment since no consistent differences in growth as between the plots were

observed during the season. All the tobacco was harvested on August 19, and when cured was sorted in the station warehouse. The cure was good with only a trace of pole sweat.

TABLE 4. UREA PLOTS. SORTING RECORD FOR 1926.

Plot No.	Source of nitrogen	Percentage of grade LW	MW	LS	SS	LD	DS	Fil	Br	Grade index
N1*****	Standard	24	7	10	9	35	1	12	2	.492
N1******	No urea	22	6	10	8	39	1	12	2	.473
N8	½ nitrogen	30	12	7	9	31	0	10	1	.545
N8*	from urea	9	5	20	9	40	1	12	4	.405
N9	All nitrogen	22	11	9	9	36	1	10	2	.489
N9*	from urea	17	5	14	7	41	1	12	3	.445

The sorting records are presented in Table 4. The yields per acre and grade indices are summarized for both 1925 and 1926 in Table 5. The quailty of the tobacco from all these plots in 1926 was rated as excellent at the time of sorting except that the veins were somewhat more prominent on the N9* plot.

TABLE 5. SYNTHETIC UREA PLOTS. ACRE YIELDS AND GRADE INDICES FOR 1925 AND 1926.

Plot No.	Nitrogen treatment	Acre yield 1925	Acre yield 1926	Ave. of 4 replications	Grade index 1925	Grade index 1926	Ave. of 4 replications
N1*****	Standard, no urea	1364	1501	1534	.268	.492	.411
N1******	" " "	1561	1711		.411	.473	
N8	½ urea	1356	1488	1544	.325	.545	.395
N8*	" "	1597	1695		.303	.405	
N9	All urea	1347	1622	1561	.257	.489	.386
N9*	" "	1465	1810		.352	.445	

Comparing the averages of the four replications as presented in Table 5, it appears that the difference in yield as between the three (less than 2%) is too small to be significant. The grade index is slightly in favor of the standard formula but here again the difference is pretty small.

Although it would probably be unwise at present to derive all the nitrogen of the fertilizer formula from urea, there is no indication of harm from using it to furnish a part of the nitrogen.

PHOSPHORIC ACID SERIES

Results of the tests of 1926 and a review of the five-year test are published as a separate bulletin, **Phosphorus Requirements of Old Tobacco Soils,** Tobacco Bulletin 7 of this station. It was found that this soil, like many other tobacco soils, has such an accumulation of phosphorus that it gives no response whatever to phosphoric acid applications.

THE OLD POTASH SERIES

The purpose of this experiment was to compare sulfate of potash-magnesia (double manure salts) with high grade sulfate of potash as a source of potash (see Tobacco Station Bul. 5, p. 24, and Bul. 6, p. 22, for more detailed description of the experiment and composition of the fertilizer mixtures). The six plots of one-fortieth acre each are located on Field 1 on the Tobacco Station farm. The fertilizer mixture is a standard formula and the same for all plots except for the source of potash. For the K1 plots all potash was in sulfate of potash, for the K2 plots it was in double sulfate of potash-magnesia, and for the K3 plots it was derived equally from each of these carriers. No change was made in the formula for 1926 except for the omission of precipitated bone. Fertilizer was applied on May 22d and the plants set on June 4th. No difference in growth were apparent throughout the season. There was no indication of magnesia starvation. On account of unfavorable curing season, some of the plots had considerable pole sweat and although the brokes were sorted, the data on these plots are not as reliable as for the previous year. The yields and sorting records are presented in Table 6.

TABLE 6. OLD POTASH SERIES. YIELD AND SORTING RECORD FOR 1926.

Plot No.	Source of Potash	Acre yield	Percentage of grade LW	MW	LS	SS	LD	DS	Fil	Br	Grade index
K1	High grade sulfate	1739	11	7	31	1	40	0	9	1	.471
K1*		1832	18	10	23	2	37	0	9	1	.505
K2	Sulf. of pot.-mag.	1831	13	7	30	2	36	1	10	1	.479
K2*		1833	10	7	29	2	36	0	9	1	.500
K3	Half from each	1712	12	6	31	2	39	0	9	1	.475
K3*		1648	11	6	30	2	39	0	11	1	.461

The yields and the grade indices for the four years of this experiment are summarized in Tables 7 and 8. Every treatment has now been replicated eight times. The difference between the average yields are approximately 2% while the average grade indices show a difference of only 1% for the four years.

TABLE 7. OLD POTASH SERIES. ACRE YIELDS FOR FOUR YEARS.

Plot No.	Form of potash	Acre yields by years 1923	1924	1925	1926	Average	Ave of 8 replications
K1	High grade sulfate	2056	1333	2054	1739	1796	1815
K1*		2056	1387	2061	1832	1834	
K2	Sulf. of pot.-mag.	1966	1413	1932	1831	1786	1781
K2*		1966	1413	1892	1833	1776	
K3	Half from each	2039	1467	2029	1712	1812	1775
K3*		2039	1333	1929	1648?	1738	

TABLE 8. OLD POTASH SERIES. GRADE INDICES FOR THREE YEARS.

Plot No.	Grade index 1924	1925	1926	Average	
K1	.281	.475	.471	.409	.415
K1*	.291	.475	.505	.422	
K2	.281	.476	.479	.412	.414
K2*	.273	.471	.500	.415	
K3	.316	.461	.475	.415	.410
K3*	.270	.483	.461	.405	

Since these differences are quite too small to be significant we *may conclude that the yield and quality of the tobacco are not* affected by the partial or complete substitution of sulfate of potash-magnesia for high grade sulphate. During these four years there has been no indication of magnesia hunger on any of the plots. Careful observations at the time of sorting and pooling by experts have failed to show any significant differences in quality. Apparently there is magnesia enough (15 lbs.) in the organic part of this fertilizer to satisfy the requirements of the crop. It does *not necessarily follow that all tobacco soils will show this same* indifference to magnesia, but since very few cases of "sand-drown" have been observed in Connecticut, we are inclined to believe that in general there is no need of using double manure salts wherever the mixture contains considerable organic material. Sulfate of potash-magnesia is a more expensive source of potash than is high grade sulfate and is more bulky. It also contains more sulfuric acid in proportion to the quantity of potash it carries. The sulfur content of the fertilizer mixture should be kept as low as possible.

Thus, unless the grower has had trouble from "sand-drown" on his field, there appears to be no advantage—and there are some disadvantages—in using sulfate of potash magnesia.

MURIATE OF POTASH

Muriate (chloride) of potash has been avoided by tobacco growers because chlorine was thought to injure the fire-holding capacity. Within the last few years, however, there has been a rekindled interest in muriate due to increased American production and to its use on some types of tobacco in the south. Since no field tests in New England are on record, two plots on Field I were treated with a fertilizer mixture exactly like the standard formula used on the N1 and P1 plots except that the potash was supplied in muriate instead of sulfate and carbonate. The plots were set at the same time as the rest of the field and all cultural operations were the same during the two years of the experiment, viz., 1925, 1926.

There were no noticeable differences in growth or other char-

acteristics in the field. When the tobacco from these plots was sorted it seemed heavier and darker and had a greasy feeling when handled. It came "into case" more quickly than the tobacco from the other plots. The sorting records for these along with the N1 and P1** plots, which were adjacent and may be regarded as controls for the K6 plots, are presented in Table 8A.

TABLE 9A. MURIATE OF POTASH AND PLOTS AND ADJACENT CHECKS. 1925-26. AND SORTING RECORDS.

Plot No.	Carrier of plot	Year	L	M	LS	SS	LD	DS	Fil	Br	Grade index	Average	Acre yield
K6	muriate	1925	3	2	24	5	45	7	3	11	.364	.378	1685
		1926	9	7	23	3	47	0	10	1	.431		1880
K6*		1925	2	4	20	6	44	12	4	8	.350		1799
		1926	5	2	25	0	44	0	22	2	.368		1594
N1	sulfate and carbonate	1925	12	9	19	4	32	7	6	11	.427	.442	1814
		1926	12	6	26	4	40	1	10	1	.457		1760
P1**		1925	11	11	16	7	26	12	8	9	.412		1717
		1926	14	6	25	4	42	0	8	1	.473		1636

According to the data presented in Table 8A, the yield is not affected by the substitution of muriate for a combination of sulfate and carbonate. There has been, however, a material lowering of the grade index; it will be noted that the percentage of dark grades has been increased by muriate.

In order to see what effect the muriate had on the fire-holding capacity, these leaves were tested along with those from plots where other forms of potash had been used. One hundred and sixty tests (electric match method) were made on the tobacco from each plot after fermentation. The results were as follows:

Tobacco fertilized with sulfate of potash burned	34.3 sec.
Tobacco fertilized with carbonate of potash burned	44.9 "
Tobacco fertilized with muriate of potash burned	4.8 "
Tobacco fertilized with 2/3 nitrate, 1/3 carbonate burned ..	43.1 "
Tobacco fertilized with ½ sulfate, ½ carbonate burned ...	38.0 "
Tobacco fertilized with 1/3 carbonate, 1/3 nitrate, 1/3 sulfate	43.5 ".

It is thus apparent that muriate has had a very serious effect on the fire-holding capacity. This conclusion is confirmed by tests in other tobacco sections of America and in other countries. An excellent review of this subject has recently been published by Dr. E. H. Jenkins (Conn. Sta. Bul. 282:92-95, 1926) to which the interested reader may refer for more detail.. In the South where muriate is used, it is not so essential that these types of tobacco have good burning qualities. Also they use only small quantities of fertilizer and tobacco is frequently grown in rotation. With our conditions, no grower can afford to apply muriate of potash either on his tobacco or on crops grown where he may wish to grow tobacco later. Some growers, however, have become unnec-

essarily alarmed because some of the ingredients used in fertilizer mixtures contain small quantities (usually less than 1%) of chlorine. It seems unlikely that such small quantities could have an appreciable effect on the burn.

CARBONATE AND NITRATE OF POTASH

The series of plots in which these two carriers of potash are being compared with sulfate is only in the second year and is planned to run at least five years. The data on the 1926 crop is presented in Table 9. A more complete discussion will be postponed until the experiment has continued longer.

TABLE 9. CARBONATE AND NITRATE OF POTASH PLOTS, 1926. YIELD AND SORTING RECORDS.

Plot No.	Potash carrier	Acre yield	Percentage of grades LW	MW	LS	SS	LD	DS	Fil	Br	Grade index
K4	sulfate	1135	5	4	8	12	34	10	22	5	.307
K4*	sulfate	1294	8	9	5	12	35	15	16	0	.351
K5	carbonate	1325	6	5	9	14	33	16	16	1	.331
K5*	carbonate	1312	5	5	14	10	38	7	15	6	.343
K7	⅔ nitr. ⅓ carb.	1350	6	4	9	15	32	15	16	3	.328
K7*	⅔ nitr. ⅓ carb.	1393	8	7	15	11	36	5	14	4	.381
K8	½ sulfate ½ carbonate	1362	7	7	9	15	34	12	14	2	.353
K8*	½ sulfate ½ carbonate	1403	6	11	15	13	38	2	12	3	.388
K9	⅓ sulf. ⅓ carb. ⅓ nitr.	1373	7	10	8	13	37	11	13	1	.364
K9*	⅓ sulf. ⅓ carb. ⅓ nitr.	1424	11	11	14	11	35	2	13	3	.388

The fertilizer was applied on May 25 and the plants set on June 5. The land here (Field V) is light and sandy; hence these plots suffered severely from the dry weather which prevailed during the early growing season and never made a satisfactory growth. All were harvested on August 10.

Thorough examination of the roots after harvesting the crop showed no serious rootrot infection on any of the plots. Occasional lesions could be found on roots from all the plots (a condition common in all old tobacco fields) but these were not more numerous on the carbonate plots than on the others. There were no differences in growth during the summer to indicate rootrot effects. The reaction of the soil on all plots was tested before application of the fertilizer in the spring and at the time of harvesting and the results compared with those taken at this time during the preceding year. During the two years of this experiment there has been no appreciable decrease in acidity on any of these plots.

The relative fire-holding capacity of the tobacco from each of these plots is indicated on p. 38. Some have objected to nitrate of potash because they said the tobacco burned with a crackling or sputtering due to the saltpetre which it was supposed to contain.

When cigars made from the crop of 1925 were smoked, however, they did not sputter or crackle although this fault was carefully watched for. Such a sputtering may frequently be observed in very "grainy" leaves in any crop of tobacco but it does not indicate that nitrate of potash was used in the fertilizer.

Strain Tests

HAVANA STRAINS

The purpose of these tests, which have now been in progress for three years, is to find whether there are in our Havana seed tobacco certain strains which are superior to others, and if so, to pick out the best ones for seed distribution and for selection with the object of further improvement. (The plan of the experiment and progress of the first two years is described in Tobacco Station Bulletin 6, pp. 37-41.) For the tests of 1926, the original eighteen strains were reduced to nine by selecting those which had the best records of performance for the two preceding years. A new strain furnished by Clark Bros. of Windsor was added as well as three rootrot resistant strains, 148C, 142C3, 142A3, and a strain selected by Dr. James Johnson of Wisconsin, called Conn. 38. These were all grown side by side in single row series on three different fields on the station farm and on the farm of Mr. Frank Solkowski of Windsor.

The plants were set on the station farm on June 4 and on the Solkowski farm on June 8. The most striking differences observed throughout the summer were the stronger growth of the resistant strains, and the close setting and greater number of leaves. The Clark strain grew taller than the others and was readily distinguished by a peculiar crinkling of the leaves. The differences between the others were not very evident in the field. Each row on Fields I and III contained 60 plants, on Field II, 30 plans and on the Solkowski field, 120 plants. Due to the fact that some of the short rows on Field II were saved for seed, the data on this field are not complete and in making the averages below (Table 11) they are omitted. The tobacco on the station farm was harvested on August 9 and on the Solkowski farm on August 20. All strains were sorted in the station warehouse. Sorting data and acre yields are presented in Table 10. These data are summarized in Table 11.

Table 10. Acre Yield and Percentage of Grades in Havana Seed Strain Tests of 1926.

Source of Seed	Rep.	Acre yield	Percentage of grades LW	MW	LS	15"	17"	LD	DS	Fil	Br	Grade index
Shean		1599	7	17	14	3	6	36	1	10	6	.409
	*	1475	6	11	17	1	4	36	2	14	9	.378
	**	1513	13	13	18	1	4	34	1	13	3	.451
	***	1894	11	11	17	1	4	39	2	12	3	.431

Source of Seed	Rep.	Acre yield	Percentage of grades LW	MW	LS	15"	17"	LD	DS	Fil	Br	Grade index
Crafts		1654	4	16	17	2	7	35	2	12	6	.380
	*	1562	8	14	10	4	5	36	6	12	5	.388
	**	1600	7	9	22	0	4	34	3	16	5	.397
	***	1920	19	12	10	2	4	43	0	9	1	.479
Brown		1747	6	12	20	3	4	34	4	11	6	.400
	*	1489	20	13	13	2	5	30	5	13	5	.495
	**	....	..	..	..	..	..	..	..	..	..	....
	***	1894	21	16	13	1	3	35	1	9	1	.513
Pelissier		1551	5	10	7	4	6	40	9	17	2	.339
	*	1489	8	7	7	2	4	46	5	16	5	.351
	**	1524	7	15	13	1	7	37	3	14	3	.396
	***	1793	20	12	8	2	5	41	2	10	0	.480
Viets		....	..	..	..	..	..	..	..	..	..	....
	*	1445	6	18	12	2	5	33	4	16	4	.388
	**	1475	5	10	11	1	5	43	2	16	7	.350
	***	1829	19	12	9	2	4	42	1	9	2	.473
Duncan		1576	5	12	13	1	5	45	4	12	3	.376
	*	1696	10	12	14	1	4	37	3	16	3	.407
	**	1530	6	10	14	0	5	36	3	16	10†	.359
	***	1937	22	15	11	1	4	35	1	9	2	.509
Henshaw		1316	4	10	15	3	5	36	5	14	8	.354
	*	1460	4	10	22	1	4	41	1	12	5	.409
	**	1536	5	24	13	0	4	28	3	14	9	.427
	***	1879	13	12	22	1	3	37	1	8	3	.470
Peckham		1623	3	17	29	1	4	32	1	15	7	.387
(?)	*	1562	11	20	13	2	4	33	1	10	6	.443
	**	1600	12	24	9	0	4	31	2	12	6	.447
	***	1973	22	20	9	1	3	33	0	9	3	.517
Kendall		1484	4	14	17	4	7	36	4	12	2	.389
	*	1360	6	13	18	1	3	34	4	15	6	.389
	**	1579	16	27	3	2	2	25	2	16	6	.456
	***	1836	23	15	8	0	3	42	0	8	1	.512
Clark		1600	9	15	16	1	3	34	1	13	8	.413
	*	1562	12	12	14	1	5	37	1	13	5	.425
	**	....	..	..	..	..	..	..	..	..	..	....
	***	1915	15	18	10	1	3	42	1	8	2	.468
148 C		1807	9	12	29	1	2	21	1	9	16	.435
	*	1635	12	9	28	1	3	23	1	10	13	.458
	**	1666	10	8	20	0	2	24	3	17	16	.388
	***	2045	18	19	15	2	3	35	0	6	2	.512
142 C3		1791	15	5	22	2	3	34	1	14	4	.449
	*	1679	19	8	17	1	4	30	2	14	5	.470
	**	1666	6	8	17	0	4	30	10	19	6	.357
	***	2174‡	11	11	16	2	4	45	0	6	5	.436
142 A3		1806	8	4	21	1	5	27	0	12	22	.363
	*	....	..	..	..	..	..	..	..	..	..	....
	**	1457	8	11	14	0	6	22	8	22	9	.361
	***	1951	12	13	21	1	4	35	0	9	5	.458
Conn. 38		1697	5	9	20	0	3	28	3	12	20	.358
	*	1577	9	15	18	4	6	30	2	12	4	.430
	**	1600	6	13	16	0	6	25	6	20	8	.367
	***	1850	24	11	13	1	4	32	0	9	6	.510

† Bundle accidentally got wet on one side and high percentage of brokes due to this.

‡ This bundle was overdamp. Probably weight is too high, therefore some deducted in making the average.

Table 11. Summary of Table 10. Based on 3 Replications.

Source of seed	Average yield	Average grade index
Shean	1656	.406
Crafts	1712	.416
Brown	1703	.469
Pelissier	1611	.390
Viets	1637	.403
Duncan	1736	.431
Henshaw	1552	.411
Peckham	1723	.449
Kendall	1560	.430
Clark	1692	.435
148 C	1829	.468
142 C3	1860	.452
142 A3	1878	.407
Conn. 38	1708	.433

As regards yield, it is apparent from these data that the resistant strains uniformly produce more tobacco than our ordinary strains. This same characteristic has been observed in other tests which we have made with these strains in previous years and other unrecorded tests of 1926. Among the other strains, the yield is good and practically equal for the Crafts, Brown, Duncan, Peckham and Conn. 38 strains. The difference between the highest and lowest of these five is less than 2% and could hardly be considered significant.

In respect to grade index, the following strains rank in the order named: Brown, 148C, 142C3, Peckham, Duncan, Kendall, Crafts. Leaving out of consideration the resistant strains (to be discussed below) it is thus seen that the four strains, Brown, Duncan, Crafts and Peckham, are in the first five both as to grade index and yield. When the samples were pooled for quality by the judges, the first six were rated in the following order: Brown, Viets, Crafts, Peckham, Kendall and Pelissier (the last three being rated equally). The Duncan strain was graded down on account of rather prominent vein in 1926. Considered from the triple standpoint of yield, grade index and judgment of quality, the Brown strain easily heads the list as it did also in the tests of 1924. The Crafts, Duncan and Peckham strains follow in the order named.

Conclusions from the three year test on Havana seed strains. As previously indicated, the first question to be answered in this series of tests was whether there are certain superior strains in the Havana seed tobacco which is grown in Connecticut and Massachusetts. To be sure, certain growers have always had the reputation of growing better tobacco, but it has not previously been shown by accurate experiment whether this was due to better land, better fertilization or cultural practices, or whether it was inherent in the strain of seed which they had. Such a problem could be answered only by growing seed from these different

growers side by side on the same land, under the same fertilization and culture and finally by keeping careful records as to yield, and sorting data and submitting the samples to expert judges of tobacco who had no knowledge of the source of the tobacco they were judging. This program has been followed now for three years as described in this and the previous report. In all the replications during this time, *no one* strain has invariably been at the top. There are, however, three, or possibly four, strains which have consistently been better and have always appeared among the highest six, viz., Brown, Crafts and Duncan, with Peckham close behind. Certain other strains have not shown up near the top in any of the tests. These trials have been conducted on different fields and under varying weather conditions. Judgment has been on the triple basis of yield, grading and quality.

These experiments prove conclusively, we believe, that there are certain strains in our Havana seed type which are inherently better than others (as well as some that are worse) and that this superiority may be depended on to remain relatively constant under varying conditions of culture, weather and soil.

Rootrot resistant strains of Havana seed. Three of the strains in this test, 148C, 142C3, 142A3, are strains which are very highly resistant to black rootrot. They have been under test at the station and in various parts of the Connecticut Valley for the last three years. In these tests it has been demonstrated beyond any question that they are very highly resistant (although not immune) to rootrot and will produce a crop where our ordinary strains will not grow tobacco worth harvesting. It has also been demonstrated that they will produce more weight per acre even on land where rootrot is not causing trouble. It will be noted in Table 10 that they produced more than a hundred pounds per acre more than any of the other strains. The only question about these strains is whether the quality is such as to meet the requirements of the trade. In the tests of the present year the experts did not rate them as high as the strains discussed above. Strain 148C in all the tests was somewhat too thin and papery. Probably if the plants were set further apart, this defect would have been less noticeable. All three of them suffered considerably from pole-sweat. This seems to be due to their ranker growth and the close setting of the leaves on the stalk. We are not yet ready to recommend that these strains be grown generally over the valley, but they should be tried out in a small way by those who have fields badly affected with rootrot.

JOHN WILLIAMS BROADLEAF STRAINS

These strain tests which have now been in progress for three years were continued in row tests on the farm of Mr. Richard P. Jones of South Windsor and on the station farm. At the latter

place the growth was not entirely satisfactory on account of the very dry weather. Growth was better on the Jones farm but the tobacco was considerably damaged by storms and delay in harvesting because of continuous rain periods and by some pole-sweat.

The sorting records are presented in Table 12. According to the judgment of the experts, the Bancroft strain was best in quality. This was also true in the 1924 tests and in one of the 1925 tests. Taking into consideration all the tests of the three years, this seems to be the best strain but with the Riordan strain a close second. These are followed in order by Hambach, Vibert and Cannon. The Miskell strain has yielded heaviest but has not been rated in quality like the others. The Jones strain was very good in 1926 but has not been tested enough times to draw any conclusions yet.

TABLE 12. JOHN WILLIAMS BROADLEAF TESTS, 1926. J, ON JONES FARM, SOUTH WINDSOR. S, ON TOBACCO STATION FARM.

Source of seed		Acre yield	Percentage of grades									Grade index†
			L	M	LS	SS	2S	LD	DS	Fil	Br	
Cannon	J	1578	2	6	32	3	22	19	3	4	9	.432
	S	....	..	..	..	..	..	..	..	..	..	....
Hambach	J	1415	3	6	25	4	20	20	5	10	7	.400
	S	1243	8	9	14	5	11	25	12	16		.385
Vibert	J	1415	2	11	34	3	16	23	2	6	3	.465
	S	1323	7	8	20	6	9	21	15	14		.400
Riordan	J	1663	8	0	28	6	13	23	2	8	3	.473
	S	1245	5	8	17	2	17	17	13	21		.358
Bankroft	J	1536	2	5	31	6	17	17	6	8	8	.419
	S	1230	9	10	15	7	15	20	9	15		.410
Miskill	J	1479	0	3	31	1	21	11	8	12	13	.369
	S	1330	3	4	16	5	14	26	13	19		.340
Grant	J	1505	0	7	37	1	19	12	2	13	9	.423
	S	1343	2	2	14	3	16	19	20	24		.292
Jones	J	1592	6	11	36	5	12	18	2	6	4	.499

† Grade index is computed on the basis of the following values for the grades.

LW	.90	SS	.50	DS	.10
MW	.60	LD	.30	Fil.	.10
LS	.70	2S	.30	Br.	.10

BANTLE BROADLEAF TESTS OF 1926

This test was on the experiment station farm at Windsor and was in duplicate. There were included five strains of seed furnished originally by:

A. E. Bidwell, East Hartford
Jacob Bantley, Glastonbury
Sherman Fox, Hockanum
J. W. Bantle, Glastonbury
Fritz Ekstrom, Glastonbury

The strains tested in 1925 from Hickey Bros. and from Benton os. were omitted because both had been obtained in recent years m Mr. J. W. Bantle and did not offer much chance of showing ferent characteristics. Yields and sorting records are presented Table 13 and the summary of the tests of the last two years in ble 14. The low yields are due to the dry early season and to fact that the experiment station farm is apparently not adapted the growing of broadleaf. It will be observed from the data in tables that the Bantley strain has been the highest yielder and o has the best grade index. The judgment of the experts placed strain from the J. W. Bantle seed a little above but with the ntley a close second. Judging from every standpoint we are lined to put the strains of the Bantle broadleaf type which we ve tested in the order of Bantley, Bantle, Ekstrom, with little oice between the others. Altogether, the differences between various seed strains of this type have not been very marked. hen grown side by side under the same conditions they are narkably uniform. The rather marked differences which the ler finds in the leaf shape and other characteristics of this type due, we believe, more to differences in soil, culture and other vironmental factors than to inherent seed differences.

TABLE 13. BANTLE BROADLEAF TEST STATION FARM, 1926.

Sourse of seed	Acre yield	Percentage of grades								Grade index
		L	M	LS	SS	2S	LD	DS	Fil & Br	
Bidwell	1429	13	14	16	1	14	23	6	13	.448
Bantley	1439	13	14	15	2	17	20	4	15	.446
Fox	1473	11	10	17	3	14	25	7	13	.430
Bantle	1385	12	12	16	2	13	22	7	16	.430
Ekstrom	1395	11	15	16	2	11	29	5	11	.417

TABLE 14. BANTLE BROADLEAF. SUMMARY OF TESTS OF 1925-26.

Source of seed	Acre yield				Grade index			
	1925 Sta.	1925 Handel	1926 Sta.	Ave.	1925 Sta.	1925 Handel	1926 Sta.	Ave.
Bidwell	1140	1244	1429	1271	.248	.416	.448	.371
Bantley	1395	1454	1439	1429	.325	.519	.446	.430
Fox	1163	1415	1473	1350	.227	.505	.430	.387
Bantle	1183	1352	1385	1307	.311	.465	.430	.402
Ekstrom	1209	1490	1395	1365	.284	.485	.417	.395

FRANK ROBERTS BROADLEAF STRAIN TESTS

These tests in 1926 were on the farm of Mr. Howard Thrall of indsor. The same eight strains which were tested during the o preceding years were grown on three different fields of the m in single row tests. The sorting data and yields of the three ts are presented in Table 15. These strains have now been

tested on seven different fields in three years. The yields of all are compared in Table 16. The differences between the strain yields are so small when the averages of the seven tests are compared that (for at least 6 or 8) they cannot be considered significant. When the grade indices for all the tests are computed we get the same result. No strain is consistently better than the others; one is a little better on one field while a different one is better on the next. The experts who have judged this tobacco during the three years have also been unable to find consistent differences in quality.

TABLE 15. FRANK ROBERTS BROADLEAF 1926 TESTS ON THRALL FARM.

Sash No.	Source of seed	Acre yield	Percentage of grades L	M	LS	SS	2S	LD	DS	F & B	Grade index
20	Roberts	1615	9	21	32	3	10	19	2	4	.530
21	Hills	1615	14	18	22	8	8	23	4	3	.528
22	Heller	1615	14	25	23	7	5	20	4	2	.553
23	McIlvane	1563	10	20	25	7	9	20	4	5	.516
24	Ensign	....	..	..	..	..	..	..	..	..	....
25	Vogel	1537	5	16	23	5	8	31	5	7	.453
26	Forbes	1492	15	18	27	4	3	20	9	4	.534
27	Evans	1537	10	21	30	3	9	16	5	6	.527
20*	Roberts	1301	4	7	33	0	21	16	9	10	.439
21*	Hills	1508	8	10	33	3	14	18	8	6	.488
22*	Heller	1346	3	7	29	3	16	23	11	8	.423
23*	McIlvane	1301	2	6	30	0	24	18	10	10	.410
24*	Ensign	1191?	7	5	27	0	24	12	8	17	.415
25*	Vogel	1279	2	5	26	1	16	16	13	21	.364
26*	Forbes	1305	9	10	25	0	20	15	7	14	.442
27*	Evans	1140	7	8	31	0	19	20	8	7	.460
20**	Roberts	1324	6	12	32	3	12	21	6	8	.478
21**	Hills	1492	1	7	33	3	18	20	11	7	.429
22**	Heller	1344	5	4	32	0	28	16	5	10	.440
23**	McIlvane	1398	1	5	27	1	15	24	14	13	.377
24**	Ensign	1344	4	5	29	2	14	24	12	10	.415
25**	Vogel	1473	2	9	30	3	13	22	11	10	.433
26**	Forbes	1490	7	13	32	3	11	16	10	8	.479
27**	Evans	1395	2	3	33	1	23	14	15	9	.374

TABLE 16. FRANK ROBERTS BROADLEAF TESTS. YIELD FOR 7 TESTS OF 1924-26.

Strain	Ensign's 1924	Ensign's 1925	Handel's 1925	Station 1925	Thrall field 1 1926	Thrall field 2 1926	Thrall field 3 1926	Average of 7 tests
Roberts	1690	1626	1381	1219	1615	1301	1324	1446
Hills	1925	1494	1230	1110	1615	1508	1493	1482
Heller	1610	1747	1331	1190	1615	1346	1344	1455
McIlvane	1610	1560	1390	1103	1563	1301	1398	1418
Ensign	1855	1698	1181	1230	1569†	1191?	1344	1438
Vogel	1680	1647	1348	1231	1537	1279	1473	1456
Forbes	1800	1682	1196	1143	1492	1305	1199	1458
Evans	1689	1693	1268	1095	1537	1140	1395	1401

† Assuming the average on this field for 1926.

Relation of Soil Reaction to Black Rootrot and Good Tobacco

M. F. Morgan[1] *and P. J. Anderson*

Over 1000 soils have now been tested for acidity. The sampling and testing of these soils has been greatly expedited through the coöperation of Messrs. B. F. Southwick of the Hartford County Farm Bureau and J. F. Owens of the Extension Service. In general, the conclusions from the first year's work (Bul. 6, p. 65) have been substantiated by the tests of the second year. We are inclined, however, to locate the safety point slightly lower on the scale than the 1925 tests would indicate. In 1925 we found all rootrot cases on soils testing above 5.95 pH (i. e., less acid than 5.95). In the early summer of 1926 (which was abnormally cold), however, we found cases in shade tobacco where the soil was slightly more acid, indicating that, for shade tobacco at least, the safety point is near 5.6. Broadleaf is more resistant and grows a good crop where shade is moderately affected. No cases of damage from rootrot have been found on soils as acid as 5.6 or below. The fact that this point is lower than in 1925 is probably due partly to the abnormally cold spring and early summer. As stated in our last report, the dividing line between rootrot and safety may be expected to shift slightly with the temperature of the soil. Again, the difference may be partly explained by the fact that a different method of testing is in use for 1926. The double wedge comparator method used in 1925 has been found to be less sensitive in the more acid range than the Morgan block method described below. Recommendations as to use of lime on soils tested are indicated in Figure 1 which has been distributed to growers who were interested in the reaction of their soils.

As far as growth alone is concerned, there have been only a few places found during this survey where the soil was too acid. On one of these, on the farm of J. E. Phelps of Suffield, experimental plots were treated with varying quantities of lime and some with acid phosphate. The response to both lime and to acid phosphate was very marked since the plots to which either considerable lime or acid phosphate had been added could be distinguished even at a considerable distance by their better growth. This response to both lime and acid phosphate lead us to believe that the active alumina liberated by the extreme acidity of the soil was the direct toxic agent in retarding growth. Further experiments with this soil, however, are in progress and will be discussed more fully at a later date.

It is a general belief that even though growth on very acid soils

[1] In charge, Soils Investigations, New Haven.

is satisfactory, the quality and burn may be improved by bringi the soil into a less acid condition through the use of lime or wo ashes. This belief seems to be substantiated by the practi experience of many farmers, but there is a great lack of scienti experiment bearing on this phase of the lime problem. Expe ments which it is hoped will throw more light on this subject a now in progress at the station, but are not yet ready to report.

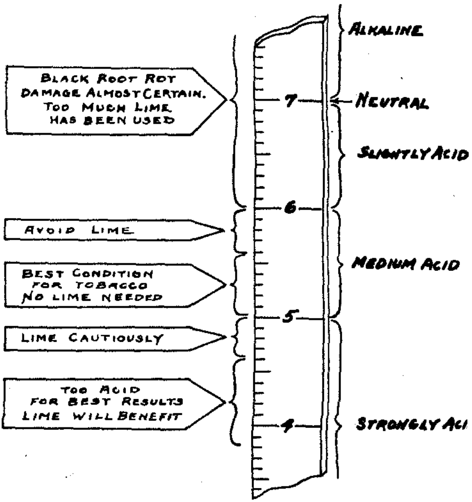


FIG. 1. The pH scale—"The Yardstick of Soil Acidity."

A NEW METHOD FOR DETERMINING SOIL ACIDITY

During the winter of 1925-26 a new method was developed b M. F. Morgan, of the Soils Department, for the rapid and acc rate determination of the soil reaction in the field. This metho has been used for all the soils tested at Windsor during the pa year. Most of the samples have subsequently been sent to Ne Haven and the pH values determined by the highly accurate ele

trometric method. The correlation has usually been very satisfactory, and the occasional discrepancies between the two methods were usually found to be due to faulty mixing or accidental contamination of the samples.

Figure 2 shows the special porcelain block used in this field test.

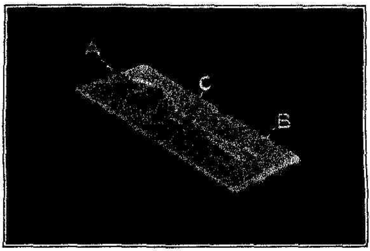


FIG. 2. Porcelain block used for soil reaction test.

Indicator solutions used are as follows:

Brom-thymol blue	(.04%)—6.0 to 7.4 pH
Brom-cresol purple or Chlor-phenol red	(.04%)—5.2 to 6.4 pH
Brom-cresol green	(.04%)—4.0 to 5.4 pH

By means of a spatula, the lower portion of depression "A" is filled with soil. By means of a medicine dropper which fits into the bottle of indicator solution, a few drops of the indicator is run into the upper portion of depression "A" until it has soaked through the soil mass and begins to run down the channel "C." If the liquid does not flow down into the depression "B" readily, it can be guided down by means of a small glass rod.

When the depression "B" is nearly full of liquid, its color is compared with a color chart showing the range of colors and pH values for the indicator used. If the color is beyond the range for that indicator, the test is repeated with the indicator for pH range above or below, as indicated.

This apparatus is being placed on the market through a commercial concern, under the name "The Morgan Soil Testing Set." It can be used by anyone who can follow directions closely, and should prove of considerable value to large tobacco growers who are interested in keeping their tobacco soils at the proper reaction.

Preservative Treatments for Tobacco Shade Cloth

H. P. Holman and T. D. Jarrell

Bureau of Chemistry, U. S. Department of Agriculture

Tobacco shade cloth is a light-weight, open, net-like, cotton fabric woven from single-ply yarns. It is used generally in the Connecticut Valley and to some extent in Porto Rico, Florida and Georgia for covering and surrounding fields of wrapper-leaf tobacco during the entire period of its growth. The cloth is usually supported by wires which are strung across the tops of nine-foot posts set eleven yards apart each way. In one direction the cloth is sewed to the wires, while in the other it simply rests on top of them. In the Connecticut Valley it is the practice to replace the cloth each season with new cloth, at a cost varying usually from $150 to $250 per acre, because it loses about half of its strength after one season's exposure and cannot be depended upon to last through a second season.

In connection with its investigations on waterproofing, mildew-proofing and fireproofing of fabrics for farm and other uses, the Bureau of Chemistry of the U. S. Department of Agriculture has for several years been trying to develop preservative treatments for tobacco shade cloth that would make it serviceable for two or three seasons instead of one. In the light of previous experience with waterproofed canvas[1] and cotton yarn[2] exposed to weather, and in view of the fact that mildew causes little damage to exposed cloth in the Connecticut Valley, it was believed that the deterioration in strength is caused by sunlight. Four years ago, in coöperation with the Tobacco Substation of the Connecticut Agricultural Experiment Station, exposure tests which continued through two seasons were started on shade cloth that had been subjected to four treatments designed primarily for protection from sunlight. Each treatment was applied to a piece of shade cloth large enough to cover two of the 11-yard squares known as "bents." Two of the treatments consisted of simply dyeing the fabric with vat dyes, in one case yellow and in the other case black. These treatments were applied by a firm manufacturing dyestuffs which firm kindly consented to coöperate to this extent. In the other two treatments pigments were used in combination with waterproofing materials that were expected to hold the pigments on the fabric. In one case burnt umber was used in conjunction with petroleum asphalt and in the other zinc oxide was used in conjunction with beeswax. Hot mineral spirits (V. M. & P. Naphtha)

[1] Industrial and Engineering Chemistry, Vol. 15, No. 6, page 607, June, 1923.
[2] *Ibid.*, 15 (1923), 236.

was used for dissolving the waterproofing material and for holding the pigment in suspension.

During the same seasons about thirty small pieces of shade cloth subjected to various experimental treatments were exposed to the weather in the vicinity of Washington, D. C.

Tensile strength tests made at the conclusion of the exposure tests, which covered a total period of about 7 months, indicated that of the treatments applied to the large pieces of cloth used for shading tobacco, the pigment treatments were better than the vat-dye treatments, and that of the latter, the black was better than the yellow. Results on the small samples exposed near Washington showed that four of the treatments were better than the others. These included azulmic acid dye, oxidized azulmic acid dye, lead chromate, and burnt umber with petroleum asphalt, the last being the same treatment as was used on one of the large pieces.

No further experiments were made with the azulmic acid products because they are not generally available. But during the seasons of 1925 and 1926 exposure tests over growing tobacco were made on large pieces of shade cloth treated with lead chromate and with petroleum asphalt solution containing lampblack in place of burnt umber. The reasons for using lampblack were that this material had been found particularly effective in reducing the injurious effect of sunlight when combined with waterproofing materials for canvas, and also because it is lighter in weight than burnt umber and therefore less likely to dust off the fabric.

The treatments were applied in the laboratory with such equipment as was available. This consisted of large copper and enameled kettles and a large clothes wringer. During treatment the cloth was manipulated with the hands, protected by rubber gloves, in order to get uniform impregnation. The treated goods were dried simply by spreading out upon the grass-covered ground. In applying the lead chromate treatment the wet cloth, after being desized with malt diastase solution, was thoroughly impregnated with a 14 per cent solution of lead acetate slightly acidified with acetic acid and, after wringing but without drying, was impregnated with a 5 per cent solution of potassium bichromate. It was then rinsed and wrung out several times to remove excess of bichromate before drying. Lead chromate amounting to about 19 per cent of the weight of fabric after desizing was put on in this way. A small piece of cloth similarly treated without previously desizing gained about 17½ per cent in weight. It might, therefore, be possible to apply the lead chromate treatment without desizing. The asphalt and lampblack treatment was applied to the dry fabric, without previously desizing, by immersing the cloth in cold mineral spirits containing about one pound of petro-

leum asphalt and six ounces of lampblack per gallon and the passing it through the wringer. The treatment added about 5 per cent to the weight of the fabric.

It was thought that the color of the treated fabric might affe the character of growth and quality of the tobacco, and in ord to permit observations being made to determine the possibility such effects areas 22 yards by 22 yards square, or 4 bents, we covered with the experimental cloth. The office of Tobac Investigations of the Bureau of Plant Industry, U. S. Departme of Agriculture, and the Tobacco Substation of the Connectic Agricultural Experiment Sstation coöperated by placing the clo for the exposure tests and by making observations on growth an quality of the tobacco. These observations showed that the was no noticeable effect from the color of the treated cloth.

Tests of tensile strength after one season's exposure indicate *that the cloth treated with lead chromate had lost 5 per cent* its strength, that the cloth treated with asphalt and lampblack ha lost 14 per cent, and that untreated cloth had lost 47 per cen After two seasons' exposure, cloth treated with the lead chroma was still considerably stronger than untreated cloth after on season's exposure. These results show that the lead chromat treatment is the better and that shade cloth heavily treated wit lead chromate can undoubtedly be used a second season.

Further experiments with the lead chromate treatment are co templated to ascertain the effectiveness of lighter treatments an to determine the practicability of the lead chromate treatment as process for preserving tobacco shade cloth when modified required for commercial application. It is not practicable to appl the treatment by hand. In any further exposure tests that ma be made, it is hoped that larger areas, of at least one acre, can b covered with the experimental cloth.

Tobacco Insects in 1926.

FURTHER EXPERIMENTS ON WIRE WORM CONTROL.

W. E. Britton[1] *and P. J. Anderson.*

The experiments of 1925 (Bul. 6, p. 78) proved that the tobac wire worms will congregate in a bait crop such as germinatin corn, leaving the surrounding soil practically free from worm and that calcium cyanide ("cyanogas") kills them in the so even when not directly in contact with them. These prelimina tests, however, were on a small scale and it still remained to b demonstrated that such a method is practicable on a large scale i the field. With this as the principal object, the experiments we

[1] Entomologist, New Haven.

continued in 1926 in coöperation with Mr. A. A. Clark of Windsor and with the American Cyanamid Company of New York. The experiments were located on the shade plantation of Mr. Clark.

Most of the fields on this plantation were fall plowed and wire worms were found in the furrows in September and October. In view of the fact that fall plowing has been advocated as a means of controlling wire worms, it is interesting to note that in so far as we could judge this had no effect on their prevalence the following year. During the latter part of April, 1926, worms were found at a depth of 8-10 inches but none above this. In order to see which fields were most infested, a few rows of corn were drilled across each field on May 7. On May 20, worms were found thickly congregated in the corn on some of the fields but not on others. They were especially numerous on a field where sod had been turned under a year previously. Corn was now drilled on all of this five-acre field. A careful examination was made a week later and the worms found in great numbers (20 to 30 worms in one corn hill was not uncommon) in and around the corn, but siftings between the rows showed that there were very few there. The number of worms was much larger in the corn drilled three weeks before than in that drilled one week before.

Since it was now believed that the maximum number had congregated, the cyanogas was applied on May 31 by means of the same 2-row drill which was used in drilling the corn. The cyanogas was placed in the fertilizer attachments of the drill, from which it flowed very uniformly and was buried in the soil at a depth of 3 to 4 inches in the same rows and approximately the same depth as the corn. The rate of application was a little less than 100 pounds per acre. Two grades of cyanogas were tried, one known as the G grade and the other a coarser, cheaper grade known as granular or crude. The latter grade did not flow quite so freely and therefore the application was not quite so heavy. One strip of land 33 x 132 feet in the center of the field was left untreated as a control. Examination four days later showed that 95% of the worms were dead where the cyanogas was applied but all alive in the control. Those which were found alive on the treated part were usually in "pockets," *i.e.*, usually a bunch of live ones together. This condition led us to believe that they had escaped because a stone or some other obstruction had caused the drill to slide up to the surface of the land in places and these pockets had not come into contact with the fumes. (This land is very stony.)

In order to see whether the fumes were still toxic to the tobacco plants, some were set at this time directly in the rows where the cyanogas had been applied. From the fact that these showed no ill effect but grew normally, we are led to believe that a delay of four days between "cyaniding" and setting may be enough.

On June 7, the field was harrowed and all set to tobacco. Five days later the field was examined and the number of dead plants counted on the treated and untreated rows. It was assumed that all dead plants were so on account of wire worm attack, although close examination showed that some had died from other causes such as broken stems or insufficient roots. The percentages obtained are therefore all slightly too high. Thirty-four per cent of the untreated plants were dead. Eight per cent of the treated had died. The record for the grade G was somewhat better than for the crude cyanogas. All were restocked at that time. When they were restocked a second time at the end of another week, 12% on the control had to be replaced as compared with 2½% on the treated.

From this experiment on a large practical scale it appears that the loss from wire worms may be very materially reduced but not completely eliminated with cyanogas.

Using tobacco plants as baits. In another field which had been set three days, Mr. Clark found the infestation severe. Thinking they must have all been attracted to these plants, he set other rows directly between the original ones and at the same time cyanided the old rows. When examined a few days later, however, the new plants were found infested almost as badly as the original rows. The worms in the original rows had been killed but apparently they had not all had time yet to congregate in the early rows or else they came up from the lower strata.

In another field, corn was planted in hills of 3 or 4 grains directly in the tobacco rows several days after setting. When the worms had collected in the corn the hills were cyanided individually. Although this method was quite successful, the labor involved is rather large. It was learned during the course of this experiment, however, that when wire worms are given a choice between corn and tobacco plant they will congregate in the corn and leave the tobacco plant untouched. As many as forty worms were found in some of these hills of corn but tobacco plants no more than a foot distant were untouched. This has suggested the possibility of baiting the worms away from the growing tobacco plants until after the latter are too large to suffer from attack. If this can be done, it may not be necessary to use cyanide at all. Meanwhile the season had advanced and the worms disappeared before we had an opportunity to make an adequate test of the suggested method. It will be tried out more extensively in 1927.

GRASSHOPPERS.

Grasshopper injury was fairly common in 1926. It is always more serious where the tobacco field is adjacent to grass or other forage crops. Since in Wisconsin these pests cause a great deal

more trouble than in New England, considerable experimental work has been done there to find methods of control. They have found there that they can be successfully poisoned with sodium arsenite. Dr. J. J. Johnson of the Department of Horticulture, University of Wisconsin, recommends the following formula to be used on tobacco fields:

Sawdust	100 lbs.
Sodium arsenite	1 qt.
Molasses	1 gal.
Salt	5 lbs.
Water	7-10 gals.

Ten to twenty pounds of this bait are used per acre, depending on the abundance of grasshoppers. It is spread on the ground along the edges of the field or, if the grasshoppers are numerous all over, it may be spread throughout the field.

Tobacco Diseases Observed in 1926.

G. P. Clinton[1] *and P. J. Anderson.*

As far as prevalence of disease was concerned, the season of 1926 was an average one, not characterized by any serious epidemic on the one hand or by extreme freedom from disease on the other. Continuing our custom established in 1925, the following records are made on the diseases observed.

Wildfire. In the early seed bed period no wildfire was known to be present. The first cases were found in the broadleaf section on May 28. Altogether the seed-bed infection in the Connecticut Valley was the lightest of any year since the disease first became prevalent. Not more than fifteen cases were known up to the end of June. The first infection in the field was found in Poquonock on June 15. Very few field infections were observed in the early growing season. During the continuous rains of the harvesting season, however, the little which was present spread enormously. It was more prevalent in the Housatonic Valley than usual, some fields there being totally ruined (Fig. 7).

Frost injury in the field. On the night of June 16, there was a heavy frost which caused considerable damage in the fields in some localities. Many fields were harrowed up at once and reset. When the plants were left, one to four leaves showed damage. Only the tender growing leaves were affected while the older leaves seemed normal. Seriously frozen leaves turned brown and died within a few days after the frost while less seriously frozen ones turned brown only in part. The bud was not killed except in the most serious cases and the leaves which had not

[1] Botanist, New Haven.

started at the time of the frost developed normally afterward. Some growers did not notice any injury at the time but after some weeks were perplexed by after-effects in the form of leaves curiously distorted and pinched in the lower half but normal toward the tips. The midribs were flanked by broad blanched or entirely white bars. The appearance of such plants is represented in figures 5 and 6. These leaves did not die but failed to develop normally. The rest of the plant developed normally and apparently the damage to the crop was not serious.

Rain bruise. This injury is caused by the beating of heavy rains on the underside of the leaves when they are turned over in a storm. It became especially prominent after some of the rains of late July and August. It is usually worse on one half of the leaf because the leaves are rarely turned completely over. In severe cases, irregular water-soaked patches of dark green to nearly black are evident immediately after the storm (Fig. 3-4). As the leaves dry out, however, the black areas gradually take on a purplish brown color which is retained until harvest and in severe cases shows up on the sorting bench and is the cause of considerable loss. In less severe cases the spots are apparent on the leaves in the field and may cause considerable worry but are not evident when the tobacco is cured.

Stem-rot and pole sweat. The curing season of 1926 was characterized by long continued rains which did not give sufficient opportunity for the sheds to dry out. This resulted in a considerable amount of pole sweat and stem-rot in all three types of tobacco. Charcoal fires were used very freely and prevented a great deal of trouble which otherwise would have developed but many started the fires too late to save the leaves which had already become affected.

The **bacterial angular leaf spot** (Fig. 9) was seen in less than a dozen fields about equally divided in the two valleys but not causing serious injury in either.

Various **leaf spot injuries** such as marbling, white ring, white speck (Fig. 10) were seen in various fields in about the average amount. The causes of these troubles have not as yet been determined. The evidence so far seems to indicate mechanical or chemical rather than parasitic agents.

The Fusarian spot (*F. affine*) is a leaf trouble somewhat similar to rain bruise but with more evident bronze or purplish-brown spots. It is found most frequently on the old leaves that have been in contact with the soil, especially on the broadleaf plants. It rarely causes any serious injury, being one of the minor fungous diseases of tobacco (Fig. 8). This year it was observed at three farms in Hockanum and Glastonbury.

Other diseases. Bed-rot was found in a few places. **Black rootrot** (Figs. 11-12) was observed in some beds and was unusually prevalent in the field in the abnormally cold early growing

season. Not many serious cases of **brown rootrot** were observed because when the acreage of New England was reduced by 10,000, most of the fields which had previously grown poor tobacco were eliminated. There were a few cases of **sore shin.** **Curly dwarf** was found in the same locality as previously. **Calico** was about as prevalent as usual, as well as the "rust" injury that often follows it. (In the interest of clarity the writers apply the term "rust" only to the dead spotted condition of the leaves following calico.)

The Heber Process of Sweating Tobacco.

P. J. Anderson

A new process of sweating by which the time is shortened to eight days—and involving certain other advantages mentioned below—has been developed by Dr. J. T. Heber of Germany and has been demonstrated at various times during the last year at the Tobacco Station where Dr. Heber has been working. Since this has received considerable publicity through the press and has created much discussion among the packers, it seems advisable that the whole process be described here and the results of the experiments conducted at Windsor briefly stated.

After tobacco leaves are cured they must go through a process of fermentation—commonly called sweating—before they are suitable for manufacture into cigars. Heat, moisture and time are required for this process. Two methods of sweating are in common use. In the first method, "bulk sweating," the tobacco is piled in large bulks of five thousand pounds and more. When it heats up to approximately 120°, the tobacco is shaken out and repiled. This process may be repeated from three to ten times and requires from three to six weeks for completion. It also involves considerable labor in shifting the bulks, and there is a shrinkage of from 5 to 10%. The above method is used mostly for shade tobacco. Other types are usually, but not always, "case" sweat. The tobacco is packed tightly in wooden cases of about 300 to 500 pounds capacity and the cases stacked up in rooms which are artificially heated to a temperature around 100°. The minimum time required for such a temperature is about six weeks.

The Heber Process may be used either for bulk or case sweating. While the hands of tobacco are being packed in the cases or laid on the bulk, each layer is lightly sprayed with the solution which contains the "active principle" of this process. The temperature of the room is then kept at 110° to 120° F. and with a humidity sufficient to keep the tobacco from drying out. This is continued for eight days and the process is complete. Experiments with up to 1000 pounds of tobacco of various pickings have been made at Windsor, some of which were taken from old tobacco soil, while others came from new soil.

The repiling of the bulk is not necessary. It would probably be necessary, however, in practice, to make the bulks smaller than they ordinarily are. The loss of weight during this process was approximately 1% during the tests conducted at Windsor.

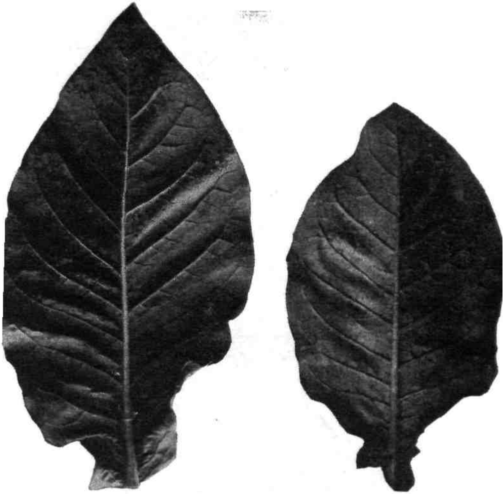
For the trade, the all important question in regard to this process is: Does it sufficiently ferment the tobacco and how does the finished product compare with that fermented by the regular process? *Since there is no chemical test by which one* may determine whether tobacco is or is not sufficiently fermented, it was necessary to rely on the judgment of dealers and other tobacco experts.

Shade tobacco thus treated was examined by many such experts and their opinion obtained. There was some difference of opinion; some believed that it was not fermented enough, some thought it was fermented too much. This difference in opinion may be explained by the fact that some tobacco men like the tobacco less fermented than others. The general opinion was that it was fermented about the same as when "bulked" by the ordinary process. It was also the general opinion that the leaves were lighter in color than when passed through the ordinary process. This difference in shade of color was brought out very strikingly when single leaves were divided and one half of each treated by the ordinary process and the other half by the Heber process. All agreed that the Heber process had kept the color lighter. Judged from the other points, uniformity of color, general appearance of the leaf, aroma, burn, etc., the experts could not find any consistent differences between the leaves cured by the two processes.

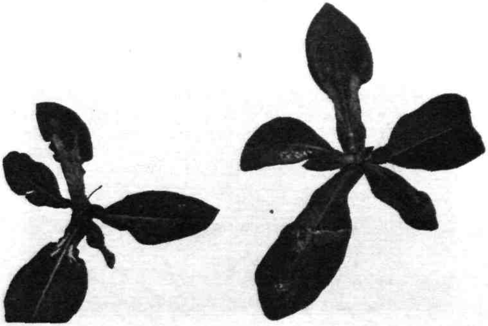
In order to determine whether the effect was due solely to the heat and moisture—rather than the Heber solution—an experiment was tried in which two boxes of tobacco were treated exactly alike except that one was sprayed with the solution and the other with an equal amount of water. When the two boxes were opened at the end of eight days, the tobacco sprayed with the Heber solution was fermented while that sprayed with water was obviously very raw and was so pronounced by the various experts who examined it.

The advantages which the Heber process may offer are:

1. Lighter shades of color
2. Less time required
3. Less loss in weight
4. Less labor
5. Less breakage



Figs. 3 and 4. Appearance of rain-bruised leaves a few hours after storm.



Figs. 5 and 6. Frost injury in field three weeks after the frost.

Plate 1. Rain Bruise and Frost Injury.

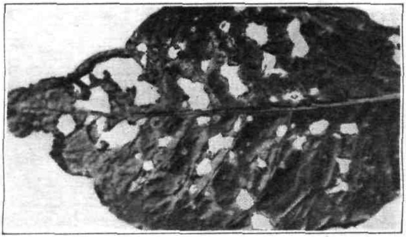


FIG. 7. Severe wildfire infection where the diseased parts have fallen out.

FIG. 8. Fusarium spot on lower leaves.

FIG. 9. Bacterial angular leaf spot.

PLATE 2. BACTERIAL AND FUNGOUS LEAF SPOTS IN THE FIELD.

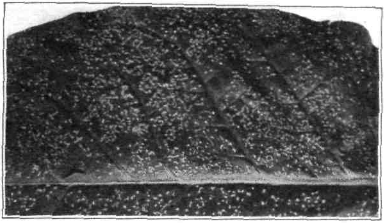


FIG. 10. White speck in the field.

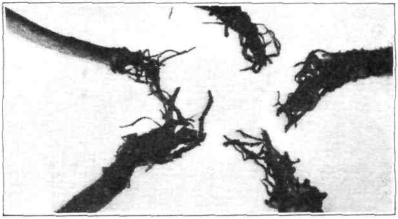


FIG. 11. Young plants with root systems totally destroyed by rootrot.

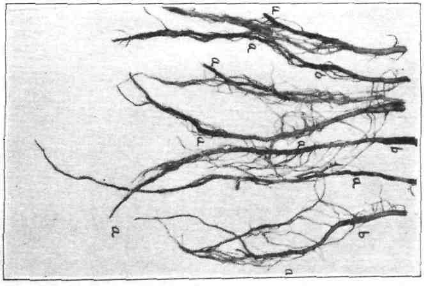


FIG. 12. Black rootrot lesions, swollen type at B, ordinary type at A.

PLATE 3 BLACK ROOTROT AND WHITE SPECK.

ILLETIN OF IMMEDIATE
FORMATION No. 55

NOVEMBER 10, 1926

Connecticut Agricultural Experiment Station

New Haven, Connecticut

The Asiatic Beetle Quarantine

(Revision Effective November 10, 1926)

W. E. BRITTON, *State Entomologist*

The Asiatic Beetle, *Anomala orientalis* Waterhouse, has appeared ring the past few years in the western or Westville section of City of New Haven, and the grubs have caused considerable

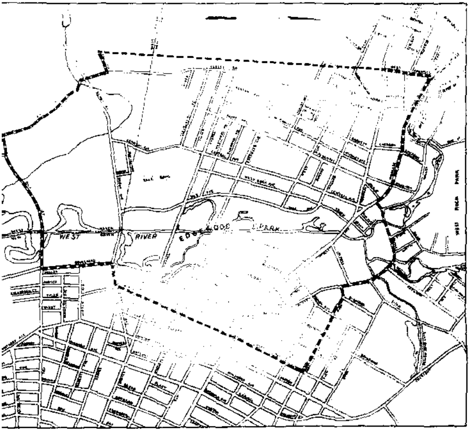


Fig. 1. Map of the Westville section of the City of New Haven. The a enclosed by the heavy dotted line is now quarantined on account of Asiatic Beetle.

injury to lawns by eating the roots of the grass. We have called it the Asiatic Beetle to distinguish it from the green Japanese beetle, *Popillia japonica* Newman, which for ten years has been present in New Jersey and around Philadelphia, and which has now spread over nearly 12,000 square miles, even into the southwest corner of Connecticut.

The Asiatic Beetle is now believed to be a native of eastern Asia but in some way it was introduced into Hawaii, where it has caused severe injury to the sugar cane crop. When control measures were first inaugurated against this pest last spring, the insect was not known to occur elsewhere in the United States, but during the summer infestations were discovered at Jericho, Long Island, and at Mount Vernon, N. Y.

Quarantine Order No. 8 was issued in the spring, effective April 15, restricting the movement of plants, soil, ground litter, etc., from the area bounded by Yale Avenue, Chapel Street, Central Avenue, Cleveland Road, Forest Road and Willard Street. During the summer beetles were found outside this area and it seemed best to extend the quarantine limits to include all territory infested, which is shown on the accompanying map.

A duly warned public hearing was held at the Station, October 19, and the revised quarantine order follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION

New Haven, Conn.

QUARANTINE ORDER No. 10

Concerning Asiatic Beetle

The fact has been determined that the Asiatic Beetle, ***Anomala orientalis*** Waterhouse, now occurs outside the area regulated under Quarantine Order No. 8, and it seems advisable to revise and extend the regulations to include the additional area.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby declare and order that the area bounded by Whalley Avenue from West Prospect Street eastward to Blake Street, to Ruby Street, to Moreland Road, to Ellsworth Avenue, southward to Derby Avenue, to Boulevard, to Oak Street, westward to Forest Road, northward to Florence Avenue, westward to the end of Florence Avenue (a point about 400 feet west of Forest Road), thence on a straight line northward to West Prospect Street, to Whalley Avenue, and all territory within these boun-

daries being partly in New Haven and partly in West Haven, shall be a regulated area out from which, until further notice, the movement of certain articles and materials will not be permitted except where inspection or treatment is practicable and permits are issued by some person or persons authorized by me to issue such permits. The restricted articles and materials are as follows:

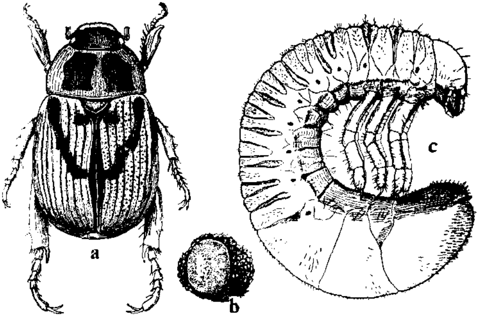


FIG. 2. The Asiatic beetle, *Anomala orientalis*. a. adult beetle. b. egg. c. grub or larva. All enlarged about five times.

1. Soil of any kind, including sand and loam.
2. All out-door plants with or without soil; potted plants which have been set on or in the ground out of doors between June 1 and September 30.
3. Turf or sod trimmings.
4. Lawn clippings during the period between June 15 and September 15.
5. Ground litter, weeds, manure, and compost which has lain upon the ground.
6. All cut flowers during the period between June 15 and September 15.

This order does not affect such materials originating outside of and passing through the regulated area.

This order shall take effect November 10, 1926.

W. L. SLATE, JR.,
Director, Connecticut Agricultural Experiment Station.

Approved:

JOHN H. TRUMBULL,
Governor.

PENALTY

Chapter 107, Public Acts of 1925, contains the following provision: "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

The foregoing regulations do not constitute an embargo, and the movement of these materials will be prohibited *only* where there is great danger of carrying the pest into uninfested territory and where inspection or treatment is considered impracticable. Permits may be issued for the movement of such materials which are not in danger of carrying the insects or which may be rendered safe by inspection or treatment.

Where to Obtain Information

Mr. J. P. Johnson has been placed in charge of enforcing this quarantine, and any one desiring to move plants and soil should make application to him. Headquarters have been established at 132 West Elm Street, telephone Colony 7215, where he may be reached during the summer months. From December 1 to April 1, the headquarters office will be closed and Mr. Johnson may be reached at the Agricultural Experiment Station, 153 Huntington Street, or by telephone, Pioneer 6450, or Liberty 1253.

BULLETIN OF IMMEDIATE
INFORMATION No. 56

NOVEMBER 10, 1926

Connecticut Agricultural Experiment Station

New Haven, Connecticut

The Japanese Beetle Quarantine

(Effective November 10, 1926)

W. E. BRITTON, *State Entomologist.*

Late in the summer, Federal scouts discovered a rather general infestation of the Japanese beetle, *Popillia japonica* Newman, on the western end of Long Island, and at several points in Westchester County, New York. One of these was at Port Chester near the Connecticut border. The scouts were then sent into the southwestern corner of Connecticut and proceeded as far as

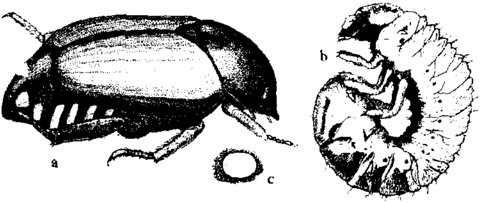


FIG. 1. The Japanese Beetle *Popillia japonica* Newman. a, adult beetle; b, grub or larva; c, egg. All enlarged about five times.

Norwalk. In the center of the city of Stamford, on Broad Street, several adult Japanese beetles were discovered on rose bushes and other shrubs and flowers, eighteen in all being taken over a period of about two weeks. On account of the spread of the Japanese beetle, not only in New York and Connecticut but also in Pennsylvania and New Jersey, it seemed necessary to revise the Federal quarantine, and a hearing was held in Washington September 25; a revised quarantine order was afterward issued, effective October 11. As the Federal quarantine applies only to interstate shipments, and as it seemed best to issue regulations governing possible shipments from Greenwich and Stamford to other points in Connecticut, notice of a hearing was distributed and published, as provided by law. The hearing was held at the Station October 19, and no one appeared in opposition. The quarantine order No. 11, effective November 10, is as follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

QUARANTINE ORDER No. 11
JAPANESE BEETLE QUARANTINE

The fact has been established by the Agricultural Experiment Station that an injurious insect known as the Japanese beetle (*Popillia japonica*) exists in the town of Stamford, Conn., and in Port Chester, N. Y.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby proclaim the towns of Stamford and Greenwich to be under State quarantine, and that it shall be unlawful to move from these towns to other points within the State (1) farm, garden, and orchard products of all kinds; (2) grain and forage crops of all kinds; (3) nursery, ornamental, and greenhouse stock, and all other plants; and (4) sand, soil, earth, peat, compost, and manure, *except under the conditions prescribed in the* following rules and regulations supplemental to this quarantine.

RULES AND REGULATIONS

Regulation 1.—*Definitions.*

For the purpose of these regulations, the following words, names and terms shall be construed, respectively, to mean:

1. JAPANESE BEETLE: The insect known as the Japanese beetle (*Popillia japonica* Newman) in any stage of its life cycle.
2. REGULATED AREA: Those portions of the State quarantined on account of the Japanese beetle and designated as being infested or immediately threatened with such infestation.
3. FARM PRODUCTS: Farm, garden and orchard products of all kinds, and grain and forage crops of all kinds.
4. NURSERY AND ORNAMENTAL STOCK: Nursery, ornamental and greenhouse stock and all other plants, plant roots, or portions of plants for ornamental use.
5. SAND, SOIL, EARTH, PEAT, COMPOST AND MANURE: Sand, soil, earth, peat, compost and manure of any kind, and as to either bulk movement or in connection with farm products or nursery and ornamental stock.
6. INSPECTOR: An inspector of the Connecticut Agricultural Experiment Station or the United States Department of Agriculture.

Regulation 2.—Regulated Area.

The towns of Stamford and Greenwich, in Fairfield County, and including any cities or borough within their limits.

Regulation 3.—Extension or Reduction of Regulated Area.

The area designated in Regulation 2 may be extended or reduced, as found necessary by the Connecticut Agricultural Experiment Station. Due notice of any extension or reduction of the areas affected thereby will be given in writing to the transportation companies doing business in the areas, and by publication in newspapers selected by the Connecticut Agricultural Experiment Station.

Regulation 4.—Regulation of Movement of Farm Products.

Regulation 5.—Regulation of Movement of Nursery and Ornamental Stock.

All movement of nursery and ornamental stock from the regulated area to other points outside such area, but within the State, shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision), and shall be permitted only upon full compliance with Regulations 6, 7 and 8 of this order: Provided, that such movement of nursery stock originating within or being transported through the regulated area during the period June 15 to October 15, inclusive, is prohibited to points outside such area within the State, unless protected from possible infestation in a manner or by a method approved by the inspector. All movement of nursery stock within the regulated area shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision).

Regulation 6.—Regulation of Movement of Sand, Soil, Earth, Peat, Compost and Manure.

(1) As a condition of certification of sand, soil, earth, peat, compost or manure for shipment both within the regulated area and from the regulated area to other points within the State, all such movements of such articles shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision).

(2) The movement of any sand, soil, earth, peat, compost and manure originating within, or being transported through the regulated area to other points outside such area within the State, during the period June 15 to October 15, inclusive, is prohibited unless protected from possible infestation in a manner or by a method approved by the inspector.

Regulation 7.—Inspection, Certification and Marking a Condition of Transportation.

Each car, vehicle, box, basket, or other container of any of the articles, in process of any movement which is restricted by Regulations 4, 5 and 6, shall be plainly marked with the name and address of both consignor and consignee, and shall bear a certificate stating that the contents have been certified by the inspector, as free from the Japanese beetle: Provided, that in case of such article moved in carload or other bulk shipments the certificate shall accompany the way-bills, conductors' manifests, memoranda, or bills of lading, or in case of truck or other road vehicles, the certificate shall accompany the vehicle. Any certificate, provided for in this act, which is forged, counterfeited, altered or defaced shall be considered as invalid and any person who shall forge, counterfeit, alter or deface such certificate shall be deemed guilty of violating the requirements of the order of the Connecticut Agricultural Experiment Station applying to the Japanese beetle and shall be liable to the penalty as outlined in Chapter 107, Public Acts of 1925.

Regulation 8.—Conditions Governing Inspection and Issuance of Certificate.

Whenever it is intended to move any of the articles or materials restricted by this quarantine order from the regulated area to points outside such area within the State, application for inspection and certification shall be made as far as possible in advance of the probable date of shipment, specifying the article and quantity to be shipped, method of shipment, and the names and addresses of both consignor and consignee.

Applicants will be required to assemble the articles and materials at such points as the inspector shall designate and to place them so that they may be readily inspected. All charges for storage, cartage, and labor incident to inspection other than the services of the inspector shall be paid by the shipper.

In case of any of the articles enumerated, where absolute freedom from infestation cannot be determined by the inspector, certification will be refused.

Regulation 9.—Cleaning of Cars, Trucks, Boats, Wagons and Other Vehicles.

Railway cars, trucks, boats, wagons, and other vehicles which have been used in transporting any article covered by this quarantine within the regulated area, must be thoroughly swept and cleaned before they will be allowed to move in transportation to other points outside the regulated area within the State.

Regulation 10.—Moving or Receiving Articles in Violation of Regulations.

No person shall move or direct any other person to move any article in violation of these regulations. No person shall receive or direct any other person to receive any article moved in violation of these regulations.

Regulation 11.—Carrying or Transporting Living Japanese Beetles outside the Regulated Area.

No person shall move or carry, or direct any other person to move or carry a living Japanese beetle to any point outside the regulated area.

This order shall take effect November 10, 1926.

W. L. Slate, Jr.,
Director, Connecticut Agricultural Experiment Station

Approved:
John H. Trumbull,
Governor

PENALTY

Chapter 107, Public Acts of 1925, provides that "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

APPENDIX

Copies of the Appendix to Federal Quarantine No. 48 (Fifth Revision), which relates specifically to shipments of nursery or ornamental stock, and sand, soil, manure, etc., may be obtained by applying to any of the following:

Japanese Beetle Office, 42 West First Street, Mount Vernon, N. Y.
Japanese Beetle Laboratory, Riverton, N. J.
Federal Horticultural Board, Washington, D. C.

APPLICATIONS FOR INSPECTIONS

Applications for inspections and certificates or permits to move nursery or ornamental stock, sand, soil, manure, etc., should be made to the Japanese Beetle Office, 42 West First Street, Mount Vernon, N. Y.

BULLETIN OF IMMEDIATE
INFORMATION NO. 57

NOVEMBER 20, 1926

Connecticut Agricultural Experiment Station

New Haven, Connecticut

REGULATIONS CONCERNING THE TRANSPORTATION OF NURSERY STOCK IN THE UNITED STATES AND CANADA*

Compiled by W. E. BRITTON, *State Entomologist.*

At the present time nearly every State in the Union has laws or regulations in regard to the inspection, certification and transportation of nursery stock. These all have one object in view, namely, the control of plant pests. But conditions are not uniform throughout the United States, and each State has established such requirements as seem to give it the best protection, with the result that there are many different regulations.

This situation assumes a serious aspect to the nurseryman who may wish to fill orders received from eighteen or twenty or more different States. In order to tabulate and bring together these varying regulations in convenient form for the use of Connecticut nurserymen, this bulletin has been prepared. It should be understood that it presents only a brief digest in each case, and if any points are not clear, the nurseryman should write to the officer in charge of inspection in that State, for more information.

In addition to the various State laws and regulations, there are several Federal quarantines regulating the shipment of nursery stock. A digest of these has been included in this bulletin, together with the regulations of the District of Columbia and of the Dominion of Canada.

FEDERAL QUARANTINES

The following Federal Quarantines concern the shipment of nursery stock:

White Pine Blister Rust: Quarantine No. 63 prohibits the interstate movement of all five-leaved pines from the District of Columbia, all States east of the Mississippi River, Louisiana, Arkansas, Missouri, Iowa and Minnesota, into any State lying

* Revised edition of Bulletin of Immediate Information, No. 51, October 1, 1925.

west of the western boundary of this area, or from one of these States into another except as they are grouped by areas. The New England States comprise one area. Five-leaved pines may not be shipped out of New England but may be shipped from one New England State to another by complying with Regulation 5 (a) and (e); viz.: each car, box or container shall be marked to show contents, names of both consignor and consignee, and must be accompanied by a certificate executed by a responsible inspection official, and based on a recent inspection of stock and premises, and showing freedom from blister rust; where any State has legally established a blister rust control area, then such stock cannot enter without a permit from that State. Black currants are prohibited from interstate movement in all of the Northeastern States. Currants and gooseberries (other than black currants) except in compliance with Regulation 5 (c) and (e); each car, box or container shall be marked to show contents, names of both consignor and consignee, and must be accompanied by a certificate executed by a responsible inspection official, and based on a recent inspection of stock and premises and showing freedom from blister rust; stock must be shipped only when dormant and must be dipped (except roots) in a mixture of one part lime-sulphur, testing not less than 32° Baumé, to eight parts water; where any State has legally established a blister rust control area, then such stock cannot enter without a permit from that State.

Narcissus Bulbs: Quarantine No. 62 provides that all varieties of narcissus bulbs can be shipped interstate only after inspection (and treatment if found infested) and certification in the State where grown. Each car, box, or other container must bear names and addresses of both consignor and consignee, list of contents, and certificate to the effect that such bulbs were found free from bulb flies and eelworms, or that such bulbs have been treated according to regulations.

Black Stem Rust of Grains: Quarantine No. 38, as amended, prohibits the interstate movement of the common species of barberry and their horticultural varieties, except the Japanese barberry; also *Mahonia* from about three-fourths of the States.

European Corn Borer: Quarantine No. 43 (third revision, as amended) provides that the stalks of common host plants of the European corn borer (which include some herbaceous perennials) cannot be shipped interstate outside of the infested areas unless inspected and provided with a Federal certificate.

Gipsy Moth and Brown-Tail Moth: Quarantine No. 45, as amended, regulates the interstate shipment of all nursery stock, forest products, stone and quarry products from the infested area in the New England States, and from the generally infested to the lightly infested areas within those States. Nursery stock must be inspected and certified by Federal inspectors.

Japanese Beetle: Quarantine No. 48, as revised, regulates the interstate shipment of all nursery stock out of the infested area which includes New Jersey and certain portions of the States of Pennsylvania, Delaware, New York and Connecticut. Such stock can be shipped only after it has been examined and certified by Federal inspectors.

Satin Moth: Quarantine No. 53, as revised, prohibits the interstate shipment from the infested areas in Maine, Massachusetts, New Hampshire, Rhode Island, Connecticut and Washington of all species and varieties of willow and poplar trees or parts thereof capable of propagation.

For further information regarding Federal quarantines and regulations address: Federal Horticultural Board, U. S. Department of Agriculture, Washington, D. C.

District of Columbia

Each package of nursery stock entering the District must bear a valid certificate of inspection, must be marked "plants," with name and address of both consignor and consignee. No package shall be delivered to the consignee until authorized by the inspector of the Federal Horticultural Board.

Federal quarantines prohibit the entry of all five-leaved pines and *Ribes* grown in the New England States, and the States of New York and Washington.

Federal Horticultural Board, Washington, D. C.

Dominion of Canada

Nursery stock from the United States can enter Canada only after a permit has been secured from the Secretary, Destructive Insect and Pest Act Advisory Board, Ottawa, Can. Applications must specify kind, quantity, value, source and destination of stock, with name and address of consignee and the customs port. All shipments must bear certificates of inspection issued by a State or Federal officer, and where required, certificates of fumigation. Unless these certificates are attached, the shipments will not be released by the Collector of Customs. Plants exempt from fumigation requirements include greenhouse plants, roses grown under glass (up to three inches), herbaceous plants, strawberry plants, blackberry plants, grape vines, conifers, bulbs and corms, if accompanied by the consignor's certificate regarding contents of shipment. Fruit and nut scions are exempt from fumigation only when forwarded by mail under official labels requiring their reinspection at Montreal or Vancouver.

Quarantines prohibit the entrance of conifers and decorative plants (such as holly and laurel), and Christmas greens from New England: all five-leaved pines, chestnuts and chinquapin, all species of currants and gooseberries, European buckthorn and all varieties of *Berberis vulgaris*, all varieties of *Corylus* into British Columbia, all peach stock and fresh peaches from the States of Wisconsin, Illinois, Missouri, Arkansas, Mississippi and eastward to the Atlantic Ocean.

Arthur Gibson, Chairman; L. S. McLaine, Secretary, Destructive Insect and Pest Act Advisory Board, Department of Agriculture, Ottawa, Canada.

Postal Regulations Regarding Nursery Stock Shipped by Parcel Post

The U. S. Postal Laws and Regulations, Section 467, paragraph 2, governing the mailing of plants and plant products, reads as follows:

"Nursery stock, including all field-grown florists' stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits and other seeds of fruit and ornamental trees or shrubs, and other plants and plant products for propagation, *except field, vegetable and flower seeds, bedding plants and other herbaceous plants, bulbs and roots*, may be admitted to the mails only when accompanied with a certificate from a State or Government inspector to the effect that the nursery or premises from which such nursery stock is shipped has been inspected within a year and found free from injurious insects, and plant diseases, and the parcel containing such nursery stock is plainly marked to show the nature of the contents and the name and address of the sender."

State Regulations

FILING OF CERTIFICATES IN OTHER STATES

In order to ship nursery stock into the following States, it is necessary to file duplicate inspection certificates:

Alabama	Massachusetts	Oklahoma
Arkansas	Michigan	Oregon
Connecticut	Minnesota	Pennsylvania
Florida	Mississippi	South Carolina
Georgia	Missouri	South Dakota
Illinois	Montana	Tennessee
Indiana	New Mexico	Texas
Iowa	New York	Utah
Kentucky	North Carolina	Virginia
Louisiana	North Dakota	Wisconsin
Maryland	Ohio	Wyoming

Though not absolutely required by law, certificates may be filed in the following States:

Kansas	Nebraska

FILING OF BONDS

Bonds are required in the following States:

Arkansas	$1.000.00	Montana	$1,000.00	Oklahoma	$1,000.00
Georgia	1,000.00	North Dakota	500.00	Oregon	1,000.00
Idaho	5,000.00	Ohio	1,000.00	Utah	500.00
Michigan	1,000.00			Washington	1,000.00

Tennessee requires a bond of $5,000.00 where trees are planted by outside nurserymen under contract to prune and spray for a period of years.

PAYMENT OF FEES

The payment of fees is required for registration in certain States, as follows:

State	*Registration Fee*	*Agent's Fee*	*State*	*Registration Fee*	*Agent's Fee*
Alabama	$10.00	$1.00	Ohio	$5.00	$1.00
	(Dealer's)—10.00		Oklahoma	5.00	
Arkansas	5.00	1.00	Oregon	10.00	1.00
Georgia	5.00	1.00	South Dakota	1.00	1.00
Idaho	10.00	1.00	Tennessee (Dealer's)		5.00
Indiana	1.00	1.00	(Agent's)		1.00
Kentucky	5.00	5.00	Texas	5.00	
Maine	5.00		Virginia	5.00	1.00
Michigan	5.00		Washington	5.00	1.00
Montana	25.00*		West Virginia	20.00	
North Dakota	10.00		Wyoming	15.00	

FUMIGATION

All deciduous nursery stock subject to the attack of San José scale must be fumigated with hydrocyanic acid gas and labeled with a certificate or affidavit stating that this has been done before it will be allowed to enter the following States:

Colorado	Michigan	North Carolina
Delaware	Mississippi	Tennessee
Florida		Utah

STATE TAGS

State tags are required and will be furnished at the shipper's expense, by the following States:

Alabama	Louisiana	Virginia
Arkansas	Mississippi	West Virginia
Florida	North Carolina	Wyoming
	South Carolina	

* Covering all Montana agents. Agents for unlicensed nurseries must pay annual fee of $10.00 and file bond of $1,000.00. Inspection fees $10.00 per car lot, smaller lots in proportion. Unlicensed nurseries, 10 per cent. of invoice price, with minimum of 50 cents per package.

Special Inspection and Certification of Raspberry Plants

In an attempt to control mosaic and allied diseases of raspberry plants, certain states require two summer inspections; one in June, and the other a month later, and after all mosaic plants discovered at the first inspection have been removed. If the plants are then free from mosaic diseases, a certificate to that effect may be granted. The following states require this special inspection and certification for shipping raspberry plants:

Michigan	New York
Minnesota	Vermont

Requirements of Various States

Alabama: Nurserymen in other States wishing to ship stock into Alabama must obtain an Alabama license by filing a signed copy of inspection certificate, with fee of $10.00. Each package of nursery stock entering the State must bear an Alabama tag which is furnished at cost. Dealers must register, file list of all nurseries from which they purchase stock, pay fee of $10.00, and obtain a dealer's certificate. An agent's certificate (cost $1.00) must be obtained through the principal for each agent selling nursery stock in Alabama. Nursery stock infested with San José scale, new peach scale, woolly aphis, brown-tail moth, gipsy moth, crown gall, black knot, citrus canker, peach yellows, pear blight, apple blotch, root nematode, peach borer, grape phylloxera or nut grass, must not be sold in Alabama.

B. P. Livingston, Chief, Division of Plant Industry, Montgomery, Ala.

Arizona: All nursery stock and plant products entering Arizona through the U. S. mails or transported in any manner shall be prominently labeled, showing (a) name and address of consignor; (b) name and address of consignee; (c) certificate of inspection; (d) locality where grown, and (e) contents of shipment. Common carriers shall not deliver to consignee any shipment of nursery stock or plant products until inspected by the State Entomologist or his agent and a certificate of release issued in each case to the common carrier and to the consignee. Postmasters are required to forward all parcels of nursery stock or plant products to the nearest Post Office Inspection Station, and cannot forward from these stations to point of destination any parcel of nursery stock or plant products unless accompanied by an inspected plant shipment tag.

Quarantines prohibit the entrance of: Olive nursery stock and olive root cuttings from all other States and foreign countries; peach, nectarine or apricot trees or cuttings, grafts, scions, buds or pits, or trees budded or grafted upon peach stock from Massachu-

setts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, Ohio, Indiana, Michigan, Illinois, West Virginia, Tennessee, North Carolina, Arkansas, Nevada, Florida, and Ontario, Can., and any other section in which peach yellows or rosette are known to exist; peach, nectarine, almond, apricot, plum, cherry, choke-cherry, quince, pear, and apple trees or plants or parts thereof including the fresh fruits and all barrels, boxes, baskets or other containers that have been used to hold the same from the States of Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Indiana, Louisiana, Maryland, Mississippi, North Carolina, New Jersey, New York, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia, and the District of Columbia on account of the Oriental fruit moth. Pecan, hickory and Japanese walnut trees, cuttings, grafts, scions and buds from all outside sources on account of the pecan leaf case-bearer.

O. C. Bartlett, State Entomologist, Box 1857, Phoenix, Ariz.

Arkansas: In order to ship nursery stock into Arkansas, it is necessary (1) to file a nursery inspection certificate, pay a fee of $1.00 and secure a permit-certificate, and (2) every shipment into the State must bear a copy of the permit-certificate with chief inspector's facsimile signature, and tags must be purchased of the chief inspector.

Out-of-state nurserymen having agents or representatives soliciting orders, or doing other nursery business in Arkansas must (1) file a bond of $1,000.00, (2) pay $5.00 for a license to do business in the State, and (3) pay $1.00 for a license for each agent in the State.

Quarantines prohibit entrance of chestnut trees from all States east of the Mississippi River.

P. H. Millar, Acting Chief Inspector, Little Rock, Ark.

California: All shipments of nursery stock, plants, seeds, etc., into California, must be conspicuously marked with name and address of both consignor and consignee and declaration of contents and origin. All stock entering the State held until inspected.

Peach, nectarine or apricot trees or cuttings, grafts, scions, buds or pits of such trees, or any trees budded or grafted upon peach stock or roots from districts where contagious peach rosette is known to exist are refused entry and will be destroyed or returned to point of shipment at option of consignor and at his expense. The States known to be infected with this disease are as follows: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Pennsylvania, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Alabama, Florida, Tennessee, Kentucky, Mississippi, Ohio, Michigan, Indiana, Arkansas, Oklahoma, and the Province of Ontario, Canada.

Quarantine order No. 36 prohibits entry of all five-leaved pines, currant and gooseberry plants from all States and districts east of and including Minnesota, Iowa, Missouri, Arkansas and Louisiana, and from the State of Washington. Quarantine order No. 38 prohibits entry of all trees, plants, grafts, cuttings or scions of all species and varieties of the cultivated filbert or hazelnut and American wild hazel (*Corylus americana*) from all States and districts east of and including Wyoming, Colorado and New Mexico. Quarantine order No. 43 prohibits entry of citrus trees and citrus fruits. Quarantine order No. 44 prohibits all chestnut and chinquapin (*Castanea* sp. and *Castanopsis* sp.) trees from all States east of east line of Idaho, Utah and Arizona. Pecan trees, hickory and Japanese walnut trees are prohibited from all states. Quarantine order No. 46, pertaining to the Oriental fruit moth, prohibits all species and varieties, including the flowering forms, of peach, nectarine, almond, apricot, plum, cherry, choke cherry, quince, pear and apple trees and parts thereof, including the fruits and all containers of such fruits, from the States of New York, Connecticut, Pennsylvania, New Jersey, Maryland, Delaware, Virginia, West Virginia, Indiana, North Carolina, South Carolina, Florida, Georgia, Alabama, Mississippi, Tennessee, Arkansas, Louisiana and Texas, and the District of Columbia.

A. C. Fleury, Supervising Quarantine Officer, Sacramento, California.

Colorado: Each package of nursery stock entering the State must bear a certificate of inspection signed by a duly authorized inspector in the State from which it was shipped, and a certificate of fumigation signed either by an inspector or by the shipper of the nursery stock. On arrival, shipments are turned over to the County Inspector who in turn, if they pass inspection, releases them to the consignee.

Quarantines prohibit the entrance of the common barberry, white pines, currants and gooseberries, the potato tuber moth and alfalfa weevil.

C. P. Gillette, State Entomologist, Fort Collins, Colo.

Connecticut: Nurseries are inspected annually and nurserymen and dealers must register: nurserymen receive registration and inspection certificates and dealers receive permits. Out-of-state nurserymen must make application and file signed copies of their valid inspection certificates and receive permits before shipping stock into the State. All stock entering the State must be accompanied by both certificate and permit, and all stock transported within the State must be accompanied by either a certificate or by a permit, and transportation companies are subject to prosecution for accepting shipments without valid certificates or permits. Nursery stock imported from foreign countries must be held

unopened until inspector arrives. Have authority to inspect any stock at destination.

Quarantine prohibits the shipment of all nursery stock and forest products, unless inspected and certified, from the gipsy moth infested area to the area uninfested.

W. E. Britton, State Entomologist, New Haven, Conn.

Delaware: Shipments of nursery stock entering the State must each bear a certificate of inspection and also a certificate stating that the stock has been properly fumigated. All shipments not provided with proper certificates will be held by the transportation companies until inspected.

Quarantines exclude all five-leaved pines and all species of *Ribes* from Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Minnesota, Wisconsin, Ohio and Michigan.

Ralph C. Wilson, Secretary, State Board of Agriculture, Dover, Delaware.

Florida: In order to ship nursery stock into Florida, duplicate inspection certificates must be filed in Florida and permit-certificate tags obtained which, together with valid inspection certificates issued in the States where the stock was grown, must accompany each box, bundle or package. All host plants of San José scale must be fumigated with hydrocyanic acid gas at the rate of one ounce of 98 per cent cyanide, two ounces sulphuric acid (sp. gr. 1.83) and four ounces water per 100 cubic feet, or thoroughly scrubbed with fish-oil soap and water (1 lb. in 3 gallons), immediately before shipment to a Florida point. Shipments of plants infected with nematode root knot, crown gall, hairy root or any insect pest or disease or markings thereof are excluded. Club orders entering Florida must have a Florida permit-tag attached to each individual order. When using a Florida permit-tag, the nurseryman must at once mail to the nursery inspector (Gainesville, Fla.) a duplicate invoice showing name and address of both consignor and consignee, itemized list of plants in shipment and serial number of Florida permit-tag used on it. All certificates on expiration and all mutilated, spoiled or unused permit-tags must be returned to the nursery inspector.

Shipments of stock liable to carry European corn borer, Japanese beetle, gipsy moth and brown-tail moth from areas under Federal quarantine for these pests will be admitted in Florida when accompanied by Federal inspection certificates, but are also subject to inspection by Florida authorities.

J. C. Goodwin, Nursery Inspector, State Plant Board, Gainesville, Fla.

Georgia: Each nurseryman, dealer, agent, salesman or solicitor must apply to the State Board of Entomology, giving (1) the

name and location of the nursery, and (2) the approximate acreage and kinds of stock grown, and receive from the Board a license: annual fee for nurserymen and dealers $5.00: annual fee for each agent, salesman or solicitor $1.00. Where a sale amounts to $100.00 or over, a duplicate of the complete invoice (without price) must be filed with the State Board of Entomology, within thirty days of shipment, with the name and address of the salesman and of the purchaser, and name and quality of all nursery stock sold in the State or for delivery in the State.

All nurserymen, corporations, firms or individuals selling or offering to sell nursery stock in Georgia must file with the Board of Entomology, and maintain for three years, a bond of $1,000.00 made out to the Secretary of the Georgia State Board of Entomology.

Quarantines prohibit shipment into the State of all five-leaved pines, currants and gooseberries; all varieties of chestnut and chinquapin nursery stock, grafts, scions or nuts for propagation from infested States; and from all States infested with the Oriental peach moth, all trees, nursery stock, fruit, twigs, cuttings, scions and other parts of peach, apple, plum, quince, cherry and all other host plants of this insect, except apple fruit; all nursery stock from sections of States where Japanese camphor scale is present. Shipments of plants from areas infested by the Japanese beetle, European corn borer, gipsy moth and brown-tail moth admitted only in strict accordance with the requirements of the Federal quarantine.

Haliard De La Parelle, State Entomologist, State Board of Entomology, Atlanta, Ga.

Idaho: No person, firm or corporation shall import or sell nursery stock by agents within the State without first applying to the Department of Agriculture, filing a bond for $5,000.00 and obtaining an annual license by paying a fee of $10.00. All shipments into the State must show name of shipper, locality where grown, variety of nursery stock and an official certificate of fumigation from the State where the stock was grown. Imported trees are fumigated before distribution, and all nursery stock shipped into the State must be inspected upon arrival at the expense of the consignee. Each nursery firm doing business in the State must annually pay an additional $1.00 for each agent. Duplicate certificates should be filed.

State quarantines exclude the entrance of all five-leaved pines, currants, gooseberries, peach, nectarine, prune, almond or other trees worked on peach stock and all pits, cuttings, buds or scions grown in a district where peach yellows or other detrimental diseases exist. There are special quarantines against the potato tuber moth and the alfalfa weevil.

M. L. Dean, Director, Bureau of Plant Industry, Boise, Idaho.

Illinois: Before shipping nursery stock into Illinois, a signed duplicate copy of the certificate of inspection must be filed with the Division of Plant Industry. Nurseries and dealers employing salesmen must file in the office of the Chief Inspector a complete list of such salesmen representing them within the State, and apply, after July 1, for an agent's permit for each salesman employed in the State. All nursery stock entering the State must bear a valid certificate of inspection, names and addresses of consignor and consignee, nature of stock and place where grown. If stock arrives without such certificate it must be reported immediately to the Division of Plant Industry, and held until released.

Quarantine orders exclude from the New England States all five-leaved pines, all species and varieties of currants and gooseberries; common barberry (*Berberis vulgaris*) and all its horticultural varieties, and all species of *Castanea*. Stock shipped into Illinois in violation of quarantines is destroyed or returned to the consignor at the discretion of the owner.

P. A. Glenn, Chief Inspector, Division of Plant Industry, Urbana, *Illinois*.

Indiana: Nursery stock entering or shipped within the State must bear an official inspection certificate, and give the names of both the consignor and the consignee. All out-of-state nurseries must file with the State Entomologist a copy of their valid inspection certificate, pay $1.00, and obtain a license good for one year from date of issue, before shipping stock into the State. Each dealer and agent selling or soliciting sales of nursery stock in Indiana must pay $1.00, and obtain a license from the State Entomologist. All foreign grown stock must be inspected at destination.

Frank N. Wallace, State Entomologist, Department of Conservation, Indianapolis, Ind.

Iowa: Copy of inspection certificate must be filed with and approved by the State Entomologist, and must accompany each shipment into the State.

Quarantine against European corn borer prohibits all the usual host plants entering the State from the infested areas in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Ohio and Michigan.

Carl J. Drake, State Entomologist, Ames, Iowa.

Kansas: Nurseries are inspected annually and all certificates and dealers' permits lapse on June 1, following date of issue. Nursery stock may be shipped into the State when accompanied by a recognized certificate of inspection. Duplicate certificates may be filed.

Quarantine prohibits the entrance of five-leaved pines, currants and gooseberries from certain middle and eastern States.

James N. Farley, Secretary, Entomological Commission, Topeka, Kans.

Kentucky: Kentucky nurseries are inspected annually and certificates are issued when stock is found free from dangerous pests. All nurserymen, resident or non-resident, file, annually, credentials at this office and if in good standing receive a permit on payment of a fee of five dollars.

Agents and dealers must file credentials annually, including names of "nurseries, nurserymen, or persons represented," and on payment of a fee of five dollars are issued a permit. Agents while soliciting orders must carry their permits, to show to prospective buyers, county officials, or agents of the State Entomologist, on demand. Quarantines are provided for. Effective on and after July 1, 1926.

H. Garman, State Entomologist, Lexington, Ky.

Louisiana: Before shipping nursery stock into Louisiana, application must be made to the Entomologist for permit by filing copy of valid certificate, and order for certificate tags accompanied by money to pay for them (price on application). The Louisiana tag and the inspection certificate of the State where the stock was grown must both accompany each shipment. The invoice stub of each permit tag must be filed with the Entomologist once a week, showing the number and varieties of plants shipped.

W. E. Anderson, State Entomologist, Department of Agriculture, Baton Rouge, La.

Maine: All individuals or firms selling or soliciting sales of nursery stock which they have not grown shall annually obtain a license from the State Horticulturist by paying a fee of $5.00. All stock entering the State shall bear on each box or package a valid inspection certificate; such stock may be inspected at destination and if found infested with dangerous pests may be destroyed or returned to the consignor.

Quarantine prohibits entrance of currant or gooseberry plants. Five-leaved pines cannot enter without a permit from the Forest Commissioner.

George A. Yeaton, State Horticulturist, Augusta, Me.

Maryland: Nurseries are inspected twice each year. Nursery stock subject to attack of San José scale must be fumigated before shipment. Shipments entering the State must bear certificates of inspection besides names of consignor and consignee. Duplicate certificate should be filed with the State Entomologist.

Quarantines prohibit the shipment of five-leaved pines, currants and gooseberries from New York, the New England States, Pennsylvania, New Jersey, Michigan, Wisconsin, Minnesota and Washington; also into the non-infested counties of Maryland, of any

nursery stock of peach or sweet cherry from areas infested with the Oriental peach moth.

Ernest N. Cory, State Entomologist, College Park, Md.

Massachusetts: All growers and agents who sell nursery stock for delivery within the State must have a grower's certificate or an agent's license, and a copy of such certificate or license must accompany each car, box or package of stock shipped or delivered. Agents must apply to Director, Division of Plant Pest Control, Boston, Mass., and file list of nursery firms from which they purchase stock before receiving agent's license. Authority is granted to inspect at destination all stock entering the State, and if found infested may be destroyed, treated, or returned to the consignor at his expense.

Quarantines prohibit *Ribes* from entering the State except under permit.

R. H. Allen, Director, Division of Plant Pest Control, Boston, Mass.

Michigan: Shipments of nursery stock entering the State must bear on each package a valid certificate of inspection showing that the contents have been inspected by a State or Government officer, and that they have been fumigated in the usual manner with hydrocyanic acid gas, together with statement of contents and names of consignor and consignee. Nurserymen of other States who employ agents to sell nursery stock in Michigan, must first file a certificate of inspection, file a bond of $1,000, pay a fee of $5.00, and obtain a license.

Quarantines prohibit raspberry plants from entering the State unless they have had two inspections, one prior to July 31, and the other in August or September at least thirty days later; also five-leaved pines and black currants from New York and the New England States, though red and white currants and gooseberries may be shipped from the vicinity of Rochester, Geneva, Fredonia and Newark, New York, provided the white pine blister rust has not been found in the vicinity within two years. Neither barberry in any of its upright forms, nor sweet chestnuts grown east of Ohio, can be shipped into Michigan, and a quarantine against the European corn borer prohibits the entrance from infested localities of the common hosts of that pest, including hardy perennials with stems.

E. C. Mandenberg, In Charge of Orchard and Nursery Inspection, Department of Agriculture, Lansing, Mich.

Minnesota: All nursery stock entering the State must bear valid certificates of inspection and any transportation companies accepting stock not so tagged are liable to prosecution. Outside nurserymen and dealers must file certificates with the State Entomologist before shipping stock into the State.

Quarantines prohibit the entry of all five-leaved pines and black currants from the New England States, New York, New Jersey, Pennsylvania, Ohio, Michigan and Wisconsin; other species of *Ribes* from these States are allowed to enter if stripped of leaves: all barberry except Japanese (*Berberis thunbergii*); raspberry plants unless certified that they have been properly inspected and found apparently free from mosaic and other systemic diseases: the usual host plants of European corn borer.

A. G. Ruggles, State Entomologist, University Farm, St. Paul, Minn.

Mississippi: Outside nurserymen and shippers must file valid inspection certificates and obtain (at cost) permit tags, which together with inspection certificate of State where stock was grown, names and addresses of consignor and consignee, nature and quantity of contents, and locality where grown must be attached to each package. State certificate must also affirm that the nursery is properly equipped for fumigating plants with hydrocyanic acid gas, and the proprietor or manager of the nursery must file an affidavit that all host plants of San José scale will be fumigated immediately before being delivered for shipment into Mississippi.

Agents or salesmen must register with and obtain certificates from the Nursery Inspector before selling, delivering or taking orders for nursery stock in the State.

Plants infected with root knot (caused by nematodes), crown gall, or showing any other evidence of pest infestation, must not be shipped into Mississippi.

All plants capable of defoliation must be defoliated. Soft ornamental plants are classed as nursery stock in Mississippi.

Quarantines provide that nursery stock classed as host plants of the European corn borer and Japanese beetle can be shipped to this State from infested districts only when the shipments are made in conformity with the United States Department of Agriculture regulations and in addition are accompanied by permit tags of the State Plant Board of Mississippi.

Geo. F. Arnold, Nursery Inspector, A. and M. College, Mississippi.

Missouri: Outside nurseries must file necessary papers including certificate and apply for a permit certificate which will be issued without fee. All agents or salesmen must apply for agent's certificate. Each package of nursery stock entering the State must bear the names of both consignor and consignee, statement of contents, and a certificate showing that the stock therein contained has been inspected where grown by a duly authorized inspector and found to be apparently free from dangerously injurious insect pests and plant diseases. Transportation companies are not permitted to deliver nursery stock unless so labeled.

Leonard Haseman, State Entomologist and Chief Inspector, State Plant Board, Columbia, Mo.

Montana: All nursery stock entering the State must be unpacked and inspected at one of the following designated quarantine stations: Billings, Butte, Miles City, Missoula, Sanders or Fairview. All shipments entering the State are subject to inspection with fees as follows: licensed nurseries, car lots $10.00, smaller lots proportionate; unlicensed nurseries, ten per cent of invoice price of shipment with minimum of 50 cents per package. Notice of shipment including list of stock and names of transportation company, consignor and consignee must be sent to the Chief, Division of Horticulture, Missoula, Montana, five days prior to shipment.

Nurserymen are required to pay an annual fee of $25.00 and file a bond of $1,000.00 in favor of the State of Montana; this includes licenses for all Montana agents. Agents for unlicensed nurseries must pay an annual fee of $10.00 and file bonds of $1,000.00.

Quarantines prohibit the entrance of the common barberry from all States, and of all five-leaved pines, currant and gooseberry plants from the States east of and including Minnesota, Iowa, Missouri, Arkansas and Louisiana and all of the State of Washington.

Edward Dickey, Chief, Division of Horticulture, Missoula, Mont.

Nebraska: All nursery stock entering the State shall bear the names of consignor and consignee and an inspection certificate issued since the preceding July 1. It is desired that duplicate certificates be filed.

Quarantine prohibits the entrance of five-leaved pines.

Myron H. Swenk, State Entomologist, University of Nebraska, Lincoln, Neb.

Nevada: All nursery stock entering the State must bear on each car, bale, or package a copy of a valid official inspection certificate, and names of consignor and consignee. Transportation companies shall not deliver nursery stock lacking such certificate.

Quarantine prohibits entry of any pine trees, currant or gooseberry plants or cuttings from east of the Mississippi River or from foreign countries, and of fruit trees, and fresh fruits and their boxes or containers, from any States infested by the Oriental fruit moth.

Edward Records, State Quarantine Officer, University of Nevada, Reno, Nev.

New Hampshire: All nursery stock entering the State must bear on each container a copy of a valid inspection certificate, or an affidavit showing that susceptible plants have been fumigated.

Quarantines prohibit the entrance of all five-leaved pines, currant and gooseberry plants, except that such pines may be admitted if certified that no pine blister rust is known to occur in the nursery and that all *Ribes* had been removed from within 300 yards of the nursery; also that plants susceptible to attack of the European corn borer, gipsy moth and satin moth from infested regions cannot enter uninfested territory without inspection certificates.

W. C. O'Kane, Deputy Commissioner of Agriculture, Durham, N. H.

New Jersey: Each car or parcel of nursery stock entering the State must bear a copy of a valid inspection certificate, with a statement from the shipper that the contents are a part of the stock inspected and whether or not it had been fumigated with hydrocyanic gas. Transportation companies shall refuse for transportation within the State all nursery stock not accompanied by a certificate of inspection. All such stock entering the State may be inspected wherever found, and if infested with dangerous pests, will be destroyed.

Common carriers and New Jersey nurserymen who bring nursery stock into the State shall send notice of each shipment with full data prior to, or within twenty-four hours after, its arrival.

Quarantines prohibit the entrance of five-leaved pines from all States where the pine blister rust occurs.

Harry B. Weiss, Chief, Bureau of Statistics and Inspection, State Department of Agriculture, Trenton, N. J.

New Mexico: Before shipping nursery stock into New Mexico, a duplicate copy of a valid certificate of inspection must be filed and a permit obtained.

Quarantine prohibits the entrance of *Ribes* and *Grossularia*.

H. L. Kent, President, Agricultural College, State College, N. Mex.

New York: Nursery stock cannot enter the State or be moved within the State unless a valid certificate is attached issued by the New York State Department of Farms and Markets or by the State in which the shipment originated. Transportation companies and all persons bringing nursery stock into the State must send notice to the Department of Farms and Markets. Blanks will be furnished for such notices. An exact copy of the certificate must be attached to each package sent by mail. Stock received from abroad or from other States must not be unpacked or distributed until after inspection and release by Department of Farms and Markets.

Quarantines prohibit the entrance of five-leaved pine trees from New England, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Wisconsin and Minnesota; also of Christmas trees and woody greens from New England, except from those areas lightly or not infested by gipsy moth and then only under certificates of inspection; of raspberry plants unless apparently free from mosaic diseases and are so certified after two inspections and the removal of all diseased plants, as is practiced in New York State; other regulations concern the European corn borer, and the usual host plants can be transported from within to without the infested areas only after being inspected and certified; currants and gooseberries cannot be grown in certain pine-growing areas of the State.

George G. Atwood, Director, Bureau of Plant Industry, Department of Farms and Markets, Albany, N. Y.

North Carolina: Nursery stock can enter the State only when shipments bear North Carolina official permit tags, which will be supplied at cost on request, and the filing of a duplicate inspection certificate accompanied by an affidavit that all fruit stock will be fumigated.

Quarantines prohibit the entrance of five-leaved pines and *Ribes* from Canada, the New England States, New York, New Jersey, Pennsylvania, Ohio, Wisconsin, Minnesota and Washington.

W. V. Reed, Inspector, State Department of Agriculture, Raleigh, N. C.

North Dakota: Nursery stock entering the State must bear inspection certificates. Every person employing agents or salesmen or who solicits for the sale of nursery stock, must obtain a license by paying a fee of $10.00, filing a duplicate inspection certificate, and a $500.00 bond. License is good for one year.

Director, North Dakota Experiment Station, Agricultural College, N. D.

Ohio: Out-of-state nurserymen must file copies of their inspection certificates and obtain an Ohio certificate permitting them to solicit orders for nursery stock. Each dealer within or without the State shall obtain annually a dealer's certificate, by furnishing an affidavit that he will buy and sell only inspected stock and will maintain with the Secretary of Agriculture a list of all sources from which he obtains nursery stock. Each affidavit shall be accompanied by a fee of $5.00. All agents soliciting orders for nursery stock shall file annually a statement that he will sell only inspected stock, and pay a fee of $1.00. He shall carry an agent's certificate and a copy of the certificate held by his principal.

Each shipment entering the State shall be accompanied by a tag or poster giving an exact copy of the valid certificate. Altered certificates are prohibited.

Quarantines prohibit the entrance or shipment within the State of the common barberry and its horticultural varieties, and the common host plants of the European corn borer.

Richard Faxon, Chief, Division of Plant Industry, Department of Agriculture, Columbus, Ohio.

Oklahoma: Nursery stock entering the State must bear on each package of each shipment an inspection certificate. Nurserymen must each file a duplicate copy of his valid inspection certificate, and furnish a surety bond of $1,000.00 in favor of the State Board of Agriculture. A permit will be issued on payment of the fee of $5.00, and a copy of this permit must be attached to all shipments entering the State of Oklahoma.

All dealers within or outside the State must attach to each package of each shipment a copy of the dealer's certificate issued to them by the Board of Agriculture.

Thomas B. Gordon, State Nursery Inspector, Oklahoma City, Okla.

Oregon: The unlicensed sale or distribution of nursery stock is unlawful. The applicant must pay a fee and furnish a bond. The fee for a nurseryman, dealer or importer is $10.00, and for any agent, solicitor or salesman, $1.00. The bond shall be for $1,000.00 and shall be conditional that all stock delivered shall be true to name.

Quarantines prohibit the entry of all five-leaved pines and all species and varieties of currants and gooseberries from States east of the Mississippi River and from the State of Washington; of all hazel and filbert nursery stock from all territory east of the Province of Alberta, Canada, and the States of Idaho, Utah and Arizona; grape vines and cuttings from most of the eastern States and portions of California; cranberry nursery stock from the New England States, New York, New Jersey and Pennsylvania.

Chas. A. Cole, Secretary, State Board of Horticulture, Portland, Ore.

Pennsylvania: Nurserymen from outside the State must file duplicate copies of their valid inspection certificates, each certified by the State official in charge, and each non-resident nurseryman must supply a statement giving the exact acreage which he is growing in nursery stock and the acreage which is being grown for him under contract. Then a Pennsylvania certificate must be obtained before shipping stock into the State. Dealers are granted certificates on application and receipt of a statement from each that he will buy stock only from nurseries holding valid certificates of inspection. Agents soliciting for the sale of nursery stock in the State must obtain and carry agents' duplicate certificates. All shipments of nursery stock entering the State will be rejected unless accompanied by certificates of inspection.

Quarantines prohibit the entrance of chestnut trees, black currants, five-leaved pines, all barberry plants except Japanese barberry, and shipments of Christmas trees or woody greenery from the gipsy moth district of New England.

C. H. Hadley, Director, Bureau of Plant Industry, Harrisburg, Pa.

Rhode Island: All stock entering the State must bear a valid official certificate of inspection, but is subject to further inspection and may be destroyed or returned to the consignor if found infested. Agents must obtain agents' licenses, on stating where they expect to purchase their stock.

Five-leaved pines and *Ribes* can be shipped into the State or planted in certain parts of the State only on permission.

A. E. Stene, State Entomologist, State House, Providence, R. I.

South Carolina: Each package of nursery stock entering the State must bear a permit tag of the South Carolina State Crop Pest Commission, which may be obtained at cost by filing a duplicate certificate of inspection and fumigation.

Quarantines prohibit the entrance of chestnut plants or cuttings, five-leaved pines, currants, gooseberries and all host plants of the European corn borer. Citrus stock is allowed to enter only by special permit. Fumigation of host plants of San José scale is required.

South Carolina State Crop Pest Commission, Clemson College, S. C.

South Dakota: Out-of-state dealers may obtain certificates permitting them to solicit and fill orders in the State, by filing with the Secretary of Agriculture a certified copy of their official inspection certificates and by paying a fee of $1.00 each. All agents shall likewise obtain and carry agents' certificates bearing copies of the certificates held by their principals, and paying fees of $1.00 each.

Quarantines prohibit the entrance of all five-leaved pines and *Ribes;* of all poplars and willows from areas infested by the satin moth; all host plants of the European corn borer.

B. F. Myers, Secretary of Agriculture, Pierre, S. D.; John Hetland, Nursery Inspector, Brookings, S. D.

Tennessee: Out-of-state nurseries must file duplicate inspection certificates and the following agreement regarding fumigation:

> "We, the undersigned, agree to fumigate with hydrocyanic acid gas, according to the required strength, all nursery stock subject to attack from San José scale and other dangerous insect pests. We also agree to attach a fumigation tag to each and every shipment going into the State of Tennessee."

Every shipment must bear a valid inspection certificate and a fumigation tag, and failure to comply with these requirements subjects the stock to confiscation.

Nursery agents and dealers must file sworn statements on official Tennessee blanks which will be supplied. Each agent operating in Tennessee must pay a license fee of $1.00 and each dealer or jobber must pay $5.00.

Nurserymen selling trees under contract to prune and spray the same for a period of years are required to take out a bond of $5,000.00 before selling trees under such special contract.

State quarantines prohibit the entrance of all five-leaved pines, currants and gooseberries; all varieties of barberry except *Berberis thunbergii;* all varieties of chestnut and chinquapin from all States where chestnut blight occurs. Other restrictions apply to Japanese beetle, European corn borer, gipsy moth, sweet potato weevil and pink bollworm of cotton. Peach and pecan seedlings are allowed entrance only by special permit for experimental purposes.

G. M. Bentley, State Entomologist and Plant Pathologist, Knoxville, Tenn.

Texas: Nurserymen, florists and other shippers of nursery stock desiring to do business in Texas, must file with the Texas State Department of Agriculture a certified copy of certificate of inspection from the State Inspector of the State in which the shipment originates, and also in addition to this, a fee of $5.00 is required which must be remitted in post-office money order, cashier's check, or bank draft. This permit is good for one year, expiring on August 31 of each year.

All shipments of nursery and floral stock originating outside of the State must bear shipping tags showing the exact copy of certificate of inspection from the State Inspector of the State in which the shipment originated, and in addition thereto must have a tag showing the exact copy of permit from Texas. These tags the shipper must have printed.

Texas freight and express companies are prohibited from receiving or delivering all shipments which do not bear proper tags, showing copies of necessary permits.

Nurserymen and florists of all States who ship nursery and floral stock into Texas, are requested to file with the Department of Agriculture a copy of invoice or memorandum of each and every shipment of stock made into the State, giving the date, consignor, consignee and a list of stock shipped. The price need not be given.

Those intending to ship orange and citrus seed of all kinds into Texas must furnish the Texas Department with a certified statement from their State Plant Board, that the seed was gathered from citrus-canker-free territory, and also an affidavit that the

seeds to be shipped were treated in a corrosive sublimate solution of a strength of 1-1000.

Agents or dealers operating in Texas for nurserymen and florists outside of the State must procure proper credentials as agents from the nurserymen they represent. The form for this credential approved by the Commission of Agriculture is furnished free of charge. Each agent or dealer must be prepared to present such credential at all times.

Dealers are classed as nurserymen and are required to take out permits. Greenhouses and greenhouse plants are included for inspection by the Texas laws and all State Inspectors should advise their nurserymen, florists or owners of greenhouses that each must have a Texas certificate before they can make shipments into the State of Texas.

G. J. Scholl, Chief Nursery Inspector, Department of Agriculture, Austin, Texas.

Utah: Out-of-state nurserymen must file with Board of Agriculture a valid official inspection certificate, and names of their agents in Utah, and obtain (without fee) an annual license; file a bond for $500.00 that they will comply with the law and to cover cost of inspection, fumigation, or destruction of stock shipped into the State or sold by their agents. Agents and salesmen representing out-of-state firms must carry proper credentials.

All nursery stock entering the State must bear a valid official inspection certificate and an official certificate that the shipment has been given a cyanide fumigation for 45 minutes at the rate of one ounce to each 100 cubic feet of enclosed space. Also a notice of each shipment giving duplicate invoice, list of contents, date, and names of both consignor and consignee must be mailed to the State Agricultural Inspector. Any out-of-state shipment not bearing the proper license and certificate tags will be placed in quarantine and inspected and disinfected at the owner's expense.

H. J. Webb, State Agricultural Inspector, State Board of Agriculture, Salt Lake City, Utah.

Vermont: All nursery stock entering the State must bear valid official inspection certificates and the names and post office addresses of both consignor and consignee.

Quarantines restrict the free movement of raspberry plants on account of mosaic, leaf roll and rosette, hosts of the European corn borer, and all uninspected and non-nursery grown trees and forest products on account of the gipsy and brown-tail moths.

M. B. Cummings, State Nursery Inspector, Burlington, Vt.

Virginia: All nurseries must file valid inspection certificates, pay fee of $10.00 (checks must be certified and made payable to the Treasurer of Virginia) and obtain a certificate of registration;

duplicates for agents' use $1.00 each. State tags will be furnished at cost and one must accompany each package of stock entering the State or sold within the State.

Commissioner of Agriculture, Richmond, Va.

Washington: No person shall sell, solicit sales, or distribute nursery stock, except berry plants, without first obtaining a license ($5.00 for nurserymen and tree dealers, $1.00 for agents). Nurserymen and dealers must file a bond of $1,000.00 for compliance with the law that the stock be true to name. All licenses expire July 1st. The State is divided into eleven horticultural districts, with an inspector-at-large in charge of each district. Notice of nursery stock entering Washington must be sent to the inspector-at-large into whose district the shipment is made, and a duplicate notice sent to the Department of Agriculture, Olympia, Wash.

J. I. Griner, Supervisor of Horticulture, Olympia, Washington.

West Virginia: All nursery stock entering the State must bear a valid certificate of inspection and a West Virginia permit tag. No nursery stock shall be sold, offered for sale or delivered, without first obtaining from the Commissioner of Agriculture, a certificate of registration, annual fee $20.00.

Quarantines prohibit the entrance of all five-leaved pines, and all species and varieties of gooseberries.

W. E. Rumsey, State Entomologist, Morgantown, W. Va.

Wisconsin: Each out-of-state nurseryman must file valid certificate of inspection and obtain State license before shipping stock into the State. Each car, or package, must bear certificate tags. Each agent selling nursery stock in the State must carry an agent's duplicate certificate bearing the same number and date as that of his principal. No fees are charged.

Quarantines prohibit entrance of all five-leaved pines and all barberry bushes (except Japanese barberry) and host plants of European corn borer from infested areas; also nursery stock from gipsy moth infested areas except under Federal Certificate.

S. B. Fracker, State Entomologist, Madison, Wis.

Wyoming: Each out-of-state nurseryman must file valid certificate of inspection and deposit fee of $15.00 and receive license good until the following July 1st. Authorized shipping tags are furnished at cost, and carriers are forbidden to deliver unless each shipment bears such a tag.

Quarantines prohibit entrance of all five-leaved pines, currants and gooseberries.

C. L. Corkins, State Entomologist, Laramie, Wyoming.

OFFICERS IN CHARGE OF INSPECTION AND QUARANTINE SERVICE

abama ....B. P. Livingston, Chief, Division of Plant Industry, Montgomery, Ala.

izona ....O. C. Bartlett, State Entomologist, Phoenix, Ariz.

kansas ....P. H. Millar, Acting Chief Inspector, Little Rock, Ark.

lifornia ....A. C. Fleury, Supervising Quarantine Officer, Sacramento, Cal.

lorado ....C. P. Gillette, State Entomologist, Fort Collins, Colo.

nnecticut .....W. E. Britton, State Entomologist, New Haven, Conn.

laware ....Ralph C. Wilson, Secretary, State Board of Agriculture, Dover, Del.

orida ....J. C. Goodwin, Nursery Inspector, State Plant Board, Gainesville, Fla.

orgia ....Haliard De La Parelle, State Entomologist, Atlanta, Ga.

aho ....M. L. Dean, Director, Bureau of Plant Industry, Boise, Idaho.

inois ....P. A. Glenn, Chief Inspector, Division of Plant Industry, Urbana, Ill.

diana ....Frank N. Wallace, State Entomologist, Indianapolis, Ind.

wa ....Carl J. Drake, State Entomologist, Ames, Iowa.

ansas ....James N. Farley, Secretary, Entomological Commission, Topeka, Kans.

entucky ....H. Garman, State Entomologist, Lexington, Ky.

ouisiana ....W. E. Anderson, State Entomologist, Baton Rouge, La.

aine ....Geo. A. Yeaton, State Horticulturist, Augusta, Me.

aryland ....E. N. Cory, State Entomologist, College Park, Md.

assachusetts ...R. H. Allen, State Nursery Inspector, State House, Boston, Mass.

ichigan ....E. C. Mandenberg, In Charge of Orchard and Nursery Inspection, Department of Agriculture, Lansing, Mich.

innesota ....A. G. Ruggles, State Entomologist, University Farm, St. Paul, Minn.

ississippi ......Geo. F. Arnold, Nursery Inspector, Agricultural College, Miss.

issouri ....Leonard Haseman, State Entomologist and Chief Inspector, State Plant Board, Columbia, Mo.

ontana ....Edward Dickey, Chief, Division of Horticulture, Missoula, Mont.

ebraska ....Myron H. Swenk, State Entomologist, Lincoln, Neb.

evada ....Edward Records, State Quarantine Officer, University of Nevada, Reno, Nev.

ew Hampshire..W. C. O'Kane, Deputy Commissioner of Agriculture, Durham, N. H.

ew Jersey .....Harry B. Weiss, Chief, Bureau of Statistics and Inspection, State Department of Agriculture, Trenton, N. J.

ew Mexico ....H. L. Kent, President, Agricultural College, State College, N. Mex.

New York ....Geo. G. Atwood, Director, Bureau of Plant Industry, Department of Farms and Markets, Albany, N. Y.

North Carolina ..W. V. Reed, Inspector, State Department of Agriculture, Raleigh, N. C.

North Dakota ...*Director, Experiment Station*, Agricultural College, N. D.

Ohio ....Richard Faxon, Chief, Division of Plant Industry, Department of Agriculture, Columbus, O.

Oklahoma ....Thomas B. Gordon, State Nursery Inspector, Oklahoma City, Okla.

Oregon ....Chas. A. Cole, Secretary, State Board of Horticulture, Portland, Ore.

Pennsylvania ....C. H. Hadley, Director, Bureau of Plant Industry, Harrisburg, Pa.

Rhode Island ....A. E. Stene, State Entomologist, State House, Providence, R. I.

South Carolina ..South Carolina State Crop Pest Commission, Clemson College, S. C.

South Dakota ....John Hetland, Nursery Inspector, Brookings, S. D.

Tennessee ....G. M. Bentley, State Entomologist and Plant Pathologist, Knoxville, Tenn.

Texas ....G. J. Scholl, Chief Nursery Inspector, Department of Agriculture, Austin, Tex.

Utah ....H. J. Webb, State Agricultural Inspector, State Board of Agriculture, Salt Lake City, Utah.

Vermont ....M. B. Cummings, State Nursery Inspector, Burlington, Vt.

Virginia ....Commissioner of Agriculture, Richmond, Va.

Washington .....J. I. Griner, Supervisor of Horticulture, Olympia, Wash.

West Virginia ...W. E. Rumsey, State Entomologist, Morgantown, W. Va.

Wisconsin ....S. B. Fracker, State Entomologist, Madison, Wis.

Wyoming ....*C. L. Corkins, State Entomologist, Laramie, Wyo.*

Federal Quarantines and District of Columbia ....Federal Horticultural Board, U. S. Department of Agriculture, Washington, D. C.

Dominion of Canada ....L. S. McLaine, Secretary, Destructive Insect and Pest Act Advisory Board, Department of Agriculture, Ottawa, Can.

BULLETIN OF IMMEDIATE
INFORMATION No. 58

MAY 1, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

The Japanese Beetle Quarantine

(Revision Effective May 1, 1927)

W. E. BRITTON, *State Entomologist*

Late in the summer of 1926, Federal scouts discovered a rather general infestation of the Japanese beetle, *Popillia japonica* Newman, on the western end of Long Island, and at several points in Westchester County, New York. One of these was at Port Chester near the Connecticut border. The scouts were then sent into the southwestern corner of Connecticut and proceeded as far as Norwalk. In the center of the city of Stamford, on Broad Street, several adult Japanese beetles were discovered on rose bushes and other shrubs and flowers, eighteen in all being taken over a period of about two weeks. On account of the spread of the Japanese beetle, not only in New York and Connecticut but also in Pennsylvania and New Jersey, it seemed necessary to revise the Federal quarantine, and a hearing was held in Washington September 25; a revised quarantine order was afterward issued, effective October 11. As the Federal quarantine applies only to interstate shipments, and as it seemed best to issue regulations governing possible shipments from Greenwich and Stamford to other points in Connecticut, notice of a hearing was distributed and published, as provided by law. The hearing was held at the Station October 19, and no one appearing in opposition, Quarantine Order No. 11, effective November 10, was issued. The Federal quarantine has since been further revised, effective April 1, 1927, and corresponding rules and regulations have been adopted in State Quarantine Order No. 12, as follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

QUARANTINE ORDER No. 12
JAPANESE BEETLE QUARANTINE

The fact has been established by the Agricultural Experiment Station that an injurious insect known as the Japanese beetle (*Popillia japonica*) exists in the town of Stamford, Conn., and in Port Chester, N. Y., and that certain rules and regulations seem necessary in addition to those established in Quarantine Order No. 10, effective November 10, 1926.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby proclaim the towns of Stamford and Greenwich to be under State quarantine, and that it shall be unlawful to move from these towns to other points within the State (1) farm, garden, and orchard products of all kinds; (2) grain and forage crops of all kinds; (3) nursery, ornamental, and greenhouse stock, and all other plants; and (4) sand, soil, earth, peat, compost, and manure, except under the conditions prescribed in the following rules and regulations supplemental to this quarantine.

RULES AND REGULATIONS

Regulation 1.—Definitions.

For the purpose of these regulations, the following words, names and terms shall be construed, respectively, to mean:

(a) JAPANESE BEETLE: The insect known as the Japanese beetle (*Popillia japonica* Newman) in any stage of its life cycle.

(b) REGULATED AREA: Those portions of the State quarantined on account of the Japanese beetle and designated as being infested or immediately threatened with such infestation.

(c) FARM PRODUCTS: Farm, garden and orchard products of all kinds, and grain and forage crops of all kinds.

(d) NURSERY AND ORNAMENTAL STOCK: Nursery, ornamental and greenhouse stock and all other plants, plant roots, or portions of plants for ornamental use.

(e) SAND, SOIL, EARTH, PEAT, COMPOST AND MANURE: Sand, soil, earth, peat, compost and manure of any kind, and as to either bulk movement or in connection with farm products or nursery and ornamental stock.

(f) INSPECTOR: An inspector of the Connecticut Agricultural Experiment Station or the United States Department of Agriculture.

(g) CERTIFIED SAND, SOIL, EARTH, PEAT, COMPOST AND MANURE: Sand, soil, earth, peat, compost, or manure determined by the inspector as uninfested by the Japaneses beetle, and so certified.

(h) CERTIFIED GREENHOUSE: A greenhouse which has complied to the satisfaction of the inspector with the conditions imposed in Regulation 6. This term may apply also to potting beds, heeling-in areas, hotbeds, cold-frames, or similar plots safeguarded and treated in manner and method satisfactory to the inspector.

Regulation 2.—Plants and Plant Products Subject to Restriction.

The restrictions on the movement of plants and plant products and other articles enumerated in the following regulations will be limited to such articles when originating in or moving from the areas now or hereafter designated by the Secretary of Agriculture as regulated or quarantined.

Regulation 3.—Regulated Area.

The towns of Stamford and Greenwich, in Fairfield County, and including any city or borough within their limits.

Regulation 4.—Extension or Reduction of Regulated Area.

The area designated in Regulation 3 may be extended or reduced, as found necessary by the Connecticut Agricultural Experiment Station. Due notice of any extension or reduction of the areas affected thereby will be given in writing to the transportation companies doing business in the areas, and by publication in newspapers selected by the Connecticut Agricultural Experiment Station.

Regulation 5.—Control of Movement of Farm Products and Cut Flowers.

No restrictions are placed by these regulations on the movement of farm products and cut flowers between October 16 and June 14 inclusive.

(a) Farm Products and Cut Flowers for Which Certification Is Not Required between June 15 and October 15, inclusive.

(1) No restrictions are placed by these regulations on the movement of Irish potatoes and sweet potatoes when free from soil, watermelons, *dried fruits, dried vegetables, seeds,* grains, and, when used for packing articles other than fruits and vegetables, hay and straw.

(b) Farm Products and Cut Flowers for Which Certification Is Required between June 15 and October 15, inclusive.

Between June 15 and October 15, inclusive, farm products and cut flowers shall not be moved to points outside the regulated area, except as provided in this and the following regulations.

(1) Farm products and cut flowers which have been handled or treated in manner and by method satisfactory to the inspector, to free them from any infestation, may be certified for movement to points outside the regulated area. The number of inspection points for such certification will be limited and their location determined by shipping needs and further conditioned on the establishment at such point of provisions satisfactory to the inspector for the handling and safeguarding of such shipments during inspection.

(2) Farm products and cut flowers originating outside of and concentrated within the regulated area may be certified by the inspector for reshipment to points outside the regulated area when such shipment is made directly from the freight yards or unloading docks, subject to compliance by the shipper with provisions satisfactory to the inspector for the handling and safeguarding of such shipments pending certification and reshipment.

(3) Farm products and cut flowers, when grown in districts where the fact has been established to the satisfaction of the inspector that no infestation exists, may be certified by such inspector for direct shipment from the farms where grown to points outside the regulated area.

(4) Certification of farm products and cut flowers, for movement from freight yards, docks or markets in the regulated area to points outside such area may be withheld by the inspector during the periods of general or unusual flight, resulting in large numbers of beetles in such freight yards, docks, or markets.

Regulation 6.—Control of Movement of Nursery and Ornamental Stock.

(a) No restrictions are placed on the movement of smooth bulbs of tulip, hyacinth, gladiolus, and narcissus from the regulated area to points outside thereof.

(b) No restrictions are placed on the movement of nursery and ornamental stock originating within the regulated area to points *within* such area, except as a condition of maintaining class rating of nurseries and greenhouses [see paragraph (d)].

(c) No restrictions are placed on the movement of nursery and ornamental stock imported under permit in accordance with the provisions of the "Rules and Regulations Supplemental to Notice of Quarantine No. 37, Governing the Importation of Nursery Stock and Other Plants and Seeds into the United States" which may be entered at a port within the regulated area, when reshipped directly from the docks or freightyards of such port in the original container and marked as to each container as required in the aforesaid rules and regulations as a condition of shipment; namely, to show the general nature and quantity of the contents, the name and address of the consignee, and the country and locality where grown.

(d) Nursery and ornamental stock, other than cut flowers (see Regulation 5) shall not be moved from the regulated area to points outside of such area until certified by the inspector for such movement. For the purpose of such certification, nurseries and greenhouses within the regulated area will be classified as indicated below:

Class I.—Nurseries and greenhouses in districts included in the regulated area but in which districts neither grubs in the soil nor beetles have been found.

Class II.—Nurseries and greenhouses in districts recently or scantily infested by the beetle, but in which nurseries or greenhouses no beetles have been found and in which it has not been possible to determine any soil invasion.

Class III.—Nurseries and greenhouses in which either grubs in the soil or beetles occur, or located in districts known to be generally infested.

(e) Conditions necessary for the maintenance of the classification of nurseries and greenhouses. Nurserymen, florists, dealers, and others, in order to maintain the classified status of their nurseries and greenhouses, shall meet the following requirements governing sales and purchases:

(1) Report immediately in writing to the inspector all their sales or shipments of nursery and ornamental stock to points *outside* the regulated area, and similarly report all sales or shipments of such stock destined to other classified nurseries and greenhouses *within* the regulated area.

(2) Report immediately in writing all purchases of nursery and ornamental stock and of sand, soil, earth, peat, compost, or manure from nurserymen, florists, dealers, or others *within* the regulated area.

(3) Nurserymen, florists, dealers, or others shall restrict their purchases of nursery and ornamental stock within the regulated area to stock which is certified as to each purchase, by the inspector, as free from infestation, and the said certificate shall accompany the article when moved.

Forms for reporting sales and purchases will be supplied by the inspector and will provide for the following information: Name and address of the consignee; name and address of the consignor; date of shipment; kinds of plants and number of each kind; class and quantity of other restricted articles. The forms, when filled out, shall be sent immediately to the nearest local office of the Japanese beetle project.

(f) Control of movement from nurseries and greenhouses in Class I. Upon compliance with the requirements of Section (e) of this regulation, nursery and ornamental stock may be certified by the inspector for shipment from nurseries and greenhouses in Class I to points outside the regulated area without meeting the safeguards prescribed as a condition of shipment of plants originating in nurseries or greenhouses of Classes II and III.

(g) Control of movement from nurseries and greenhouses in Class II. Upon compliance with the requirements of Sections (e) and (i) of this regulation, nursery and ornamental stock may be certified by the inspector for shipment from nurseries and greenhouses of Class II to points outside the regulated area under the following safeguards:

(1) Outdoor-grown nursery and ornamental stock shall be examined by the inspector at the time of digging, as follows: Immediately before digging, surface soil to the depth of four inches shall be removed from about each plant and examined; the plants shall then be lifted and a careful examination made of the exterior of the soil ball and of the sides of the hole from which the plant is removed.

(2) Azaleas, rhododendrons, and other plants which are of such a nature that the removal of the soil may be harmful to the plants may, after October 10, be subjected to the following procedure in lieu of the requirements in paragraph (1): Intensive examination, by the inspector, of the

soil in the block concerned; entire removal of the soil from at least 5 per cent of the plants by the shipper or owner, and a careful examination, by the inspector, of the soil removed.

(h) Control of movement from nurseries and greenhouses in Class III. No movement of nursery and ornamental stock from nurseries and greenhouses of Class III to points *outside* the regulated area shall be allowed except upon compliance with the following restrictions:

(1) Plants with soil: Plants or classes of plants which shall be determined by the inspector as possible of effective treatment with carbon disulphide emulsion or other means, may be certified by the inspector for shipment when such treatment is performed under the direction and supervision of, and in manner and method satisfactory to, such inspector.

(2) Plants without soil: Nursery and ornamental stock from which the soil has been entirely removed by washing or shaking may be certified by the inspector for shipment: *Provided*, That plants having roots of such a nature that the inspection thereof is impracticable, shall not be certified until such plants have been treated in accordance with the requirements of the previous paragraph (1).

(3) Removal of soil from plants: The removal of soil from plants offered for inspection and shipment must be performed by the persons, firms, or corporations, or others offering such stock for shipment or sale, under the direction and supervision of, and in manner and method satisfactory to, the inspector.

(i) Conditions governing the certification of stock from greenhouses, including hotbeds, potting beds, heeling-in areas, cold-frames, etc.

The issuance of permits for movement of stock from certified greenhouses, including potting beds, heeling-in areas, hotbeds, cold-frames, or similar plots, will be conditioned on compliance with the following requirements:

(1) Ventilators, doors and all other openings in greenhouses or cold-frames on premises in Class II or Class III shall be kept screened during the period of flight of the beetle, namely, between June 15 and October 15, inclusive, in manner satisfactory to the inspector.

(2) Prior to introduction into nurseries or greenhouses, sand, soil, earth, peat, compost, or manure taken from areas in which Class II or Class III nurseries or greenhouses are located, or which may have been exposed to infestation, must be sterilized or fumigated under the direction and supervision of, and in manner and method satisfactory to, the inspector. If such treated sand, soil, earth, peat, compost, or manure is not to be immediately used in such greenhouses, it must be stored in a tightly closed building or container.

(3) Plants potted in certified soil (see Regulation 7) in nurseries or greenhouses of Class II or Class III and placed in outdoor screened frames during the period June 15 to October 15, inclusive, may be certified by the inspector for shipment to points *outside* the regulated area under the following conditions: A careful inspection shall be made of the soil from not less than 10 per cent of the pots. The soil in and including an area not less than 3 feet wide surrounding the frames shall be treated not later than the preceding October 1 with arsenate of lead powder, applied uniformly at the rate of 1,500 pounds to the acre. The soil examination and treatment shall be made under the direction and supervision of, and in manner and method satisfactory to, the inspector.

(4) Plants potted in certified soil (see Regulation 7) in nurseries or greenhouses of Class II or Class III and placed in beds in the open during the period October 16 to June 14 may be certified by the inspector for shipment to points outside the regulated area upon compliance with the following conditions performed under the direction and supervision of, and in manner and method satisfactory to, such inspector: A fine mesh screen must be placed in the bottom of each pot; the soil in beds on which

the pots are placed must have been treated, not less than three months previous to the time the pots are placed in the beds, with arsenate of lead powder applied uniformly at the rate of 1,500 pounds to the acre, under the direction and supervision of, and in manner and method satisfactory to, the inspector; no pots shall be placed within 3 feet of soil which has not been treated; before pots are placed on treated beds, careful soil examination shall be made of the beds and their freedom from infestation determined by the inspector.

(5) Nurserymen, florists, dealers, or others ordering for use in certified greenhouses, nursery and ornamental stock, or sand, soil, earth, peat, compost, or manure from other growers, dealers, or individuals within the regulated area, shall immediately report their orders to the inspector and obtain approval before such articles are received on their premises or placed in certified greenhouses.

(6) Nurserymen, florists, dealers, or others shall not move, or allow to be moved, plants from the open on their own premises into certified greenhouses until the approval for such movement has been obtained from the inspector.

Regulation 7.—Control of Movement of Sand, Soil, Earth, Peat, Compost and Manure.

(a) The movement of *fresh manure* to points outside the regulated area will be allowed without other requirements than inspection and certification by the inspector.

(b) Certification for movement of *sand, soil, earth, peat, compost, or manure (except fresh manure)* from the regulated area to points outside such area will not be allowed except upon compliance with the conditions hereinafter enumerated.

(1) The movement of the articles enumerated from districts included in the regulated area, but in which neither beetles nor grubs in soil have been found, to points outside the regulated area will be allowed without other requirement than certification by the inspector. This requirement shall apply throughout the year.

(2) The movement of the articles enumerated from districts included in the regulated area which are known to be generally infested, to points outside the regulated area, shall not be allowed except upon compliance with the following conditions:

(aa) Surface material of the articles enumerated, when removed from above a depth of 12 inches, shall be fumigated with carbon disulphide under the direction and supervision of, and in manner and method satisfactory to, the inspector before such shipments may be certified by the said inspector for such movement.

(bb) The articles enumerated, when removed under the supervision of the inspector from a depth of more than 12 inches below the exposed surface of the ground, may be so certified by the inspector without treatment for movement between October 16 and June 14, inclusive.

(cc) The articles enumerated, when removed, under the supervision of the inspector, from a depth of more than 12 inches below the exposed surface of the ground, may be certified by the inspector between June 15 and October 15, inclusive, as follows: (1) When the inspector shall determine that a general infestation of adult Japanese beetles exists at the loading and shipping points, certification shall be withheld until either the article which it is proposed to ship shall have been fumigated with carbon disulphide or until the cars and loading operations are protected by screening under the direction of, and in manner and method satisfactory to, the said inspector; (2) When the inspector shall determine that no such infestation of adult Japanese beetles exists in the vicinity of the loading and shipping points, the articles may be certified for movement without the requirement of fumigation or screening.

Regulation 8.—Conditions Governing the Protection of Restricted Articles from Japanese Beetles While in Transit.

Farm products, nursery and ornamental stock, and sand, soil, earth, peat, compost, and manure, moving between June 15 and October 15, inclusive, shall be screened, covered, or otherwise protected in manner or method determined by the inspector as necessary to prevent infestation by adult Japanese beetles of the articles listed. This requirement shall apply to each automobile, truck, wagon, car, and boat, hauling such articles from the regulated area to points outside thereof.

Regulation 9.—Marking and Certification a Condition of Transportation.

Every car, vehicle, box, basket or other container of the articles listed, the movement of which is restricted in Regulations 5, 6, and 7, shall be plainly marked with the name and address of the consignor and the name and address of the consignee and shall bear a certificate stating that the contents have been examined by the inspector and found to be apparently free from the Japanese beetle.

The inspection certificate in the case of carload and other bulk shipments shall accompany the waybill, conductor's manifest, memorandum, or bill of lading, pertaining to such shipment, or in the case of truck or other road vehicle, the certificate shall accompany the vehicle.

Misuse or transfer of certificates or use of void certificates is prohibited and may result in the refusal of further certification to the grower or shipper concerned.

Regulation 10.—Conditions Governing Inspection and Issuance of Certificates.

Persons intending to move or allow to be moved any of the articles the movement of which is restricted in Regulations 5, 6, and 7, shall make application for inspection and certification as far as possible in advance of the probable date of shipment, specifying in the application the article and quantity to be shipped, method of shipment, name and address of the consignor, and name and address of the consignee.

Applicants for inspection will be required to assemble the articles at such points as the inspector shall designate and to so place them that inspection may readily be made; if not so placed, inspection may be refused. All charges for storage, cartage, and labor incident to inspection, other than the services of the inspector, shall be paid by the shipper.

Where the apparent absolute freedom from infestation of any of the articles enumerated cannot be determined by the inspector, certification will be refused.

Regulation 11.—Inspection of Restricted Articles in Transit.

Any car, vehicle, basket, box, or other container of articles moved or offered for movement which contains or may contain articles the movement of which is prohibited or restricted by Federal Quarantine No. 48 and these regulations, shall be subject to inspection by duly authorized inspectors at place of shipment or destination or at any point en route.

Regulation 12.—Thorough Cleaning Required of Trucks, Wagons, Cars, Boats and Other Vehicles Before Moving.

Trucks, wagons, cars, boats, and other vehicles, which have been used in transporting any article covered by Federal Quarantine No. 48 within the regulated area shall not thereafter be moved or allowed to be moved until they have been thoroughly swept and cleaned by the carrier at the point of unloading or destination.

Regulation 13.—Shipments by the Connecticut Agricultural Experiment Station of the United States Department of Agriculture.

Plants and plant products and other articles, the movement of which is restricted by these rules and regulations may be moved by the Connecticut Agricultural Experiment Station or the United States Department of Agriculture, when intended for experimental or scientific purposes, on such conditions and under such safeguards as may be prescribed by the Federal Horticultural Board.

Regulation 14.—Moving or Receiving Articles in Violation of Regulations.

No person shall move or direct any other person to move any article in violation of these regulations. No person shall receive or direct any other person to receive any article moved in violation of these regulations.

Regulation 15.—Carrying or Transporting Living Japanese Beetles Outside the Regulated Area.

No person shall move or carry, or direct any other person to move or carry a living Japanese beetle to any point outside the regulated area.

These rules and regulations shall take effect May 1, 1927, shall supersede all previous rules and regulations issued in connection with Quarantine Order No. 11, effective November 10, 1926, and shall be in force until further notice.

WILLIAM L. SLATE,
Director, Connecticut Agricultural Experiment Station

Approved:

JOHN H. TRUMBULL,
Governor.

PENALTY

Chapter 107, Public Acts of 1925, provides that "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

PUBLISHED RULES AND REGULATIONS

Copies of the revised rules and regulations connected with the quarantines established on account of the Japanese Beetle may be obtained from any of the following sources:

- Connecticut Agricultural Experiment Station, New Haven, Conn.
- Japanese Beetle Office, 2000 Bronx Street, West Farms, New York City.
- Japanese Beetle Laboratory, Riverton, New Jersey.
- Federal Horticultural Board, Washington, D. C.

APPLICATIONS FOR INSPECTIONS

Applications for inspections and certificates or permits to move nursery or ornamental stock, sand, soil, manure, etc., should be made to the Japanese Beetle Office, 2000 Bronx Street, West Farms, New York City.

BULLETIN OF IMMEDIATE
INFORMATION NO. 59

JUNE 1, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

The European Corn Borer Quarantine

W. E. BRITTON, *State Entomologist*

Each year since 1923, a few infestations of European corn borer, *Pyrausta nubilalis* Hubn., have been found by Federal scouts in Connecticut, all being at points along the coast. In each case, corn stalks, stubble, weeds and rubbish have been burned around each infestation, and in some instances no infestation has since been found in the locality. Most of the infestations have occurred in New London County. In 1927, the infested towns were found

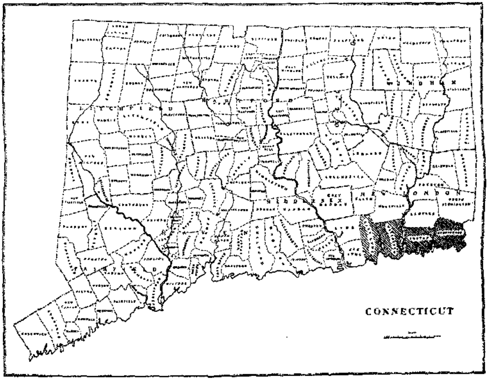


FIG. 1. Map of Connecticut; shaded area shows towns now under Federal and State quarantine on account of European corn borer.

to be connected through Rhode Island with the large infestation in eastern New England, and it seemed best to place this territory under quarantine. The Federal quarantine on the towns of East Lyme, Waterford, New London, Groton, and Stonington became

effective March 1, 1927, and applies to interstate shipments from these infested towns. After due notice, a hearing was held at New London, May 13, 1927, and a State quarantine placed on these towns by the following Quarantine Order:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
New Haven, Conn.

QUARANTINE ORDER No. 13
EUROPEAN CORN BORER QUARANTINE

The fact has been determined by the Secretary of Agriculture that an injurious insect, the European corn borer, *Pyrausta nubilalis* Hubn., not heretofore prevalent or widely distributed in Connecticut, exists in the towns of East Lyme, Waterford, New London, Groton and Stonington, now, since March 1, 1927, under Federal quarantine. After due notice, a public hearing was held at New London, May 13, 1927, where all persons interested were given a chance to appear and be heard.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby proclaim that the said towns of East Lyme, Waterford, New London, Groton and Stonington are placed under state quarantine, and that it shall be unlawful to move from this area to other points within the state, such plants and plant products, and those only in compliance with the rules and regulations as are designated on the following pages.

RULES AND REGULATIONS

Regulation 1.—Definitions.

For the purpose of these regulations the following words, names, and terms shall be construed, respectively, to mean:

(a) Corn borer: The insect known as the European corn borer (*Pyrausta nubilalis* Hubn.).

(b) Regulated area: Those portions of the state quarantined on account of the European corn borer and designated as being infested or immediately threatened with such infestation.

(c) Inspector: An inspector of the Connecticut Agricultural Experiment Station or the United States Department of Agriculture.

Regulation 2.—Plants and Plant Products Subject to Restriction.

Until further notice, unless accompanied by a certificate or permit issued by an authorized inspector, the following plants and plant materials cannot be allowed movement out of the restricted area: Corn, broom corn (including all parts of the stalk), all sorghums, sudan grass, celery, green beans in the pod, beets with tops, rhubarb, oat and rye straw as such or when used as packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolas and dahlia, except the bulbs thereof.

No restrictions are placed by this quarantine on the movement of the articles enumerated, when they shall have been manufactured, processed, or treated in such manner that in the judgment of the inspector no infestation could be transmitted.

Regulation 3.—Infested Areas.

The towns of East Lyme, Waterford, New London, Groton and Stonington, in New London County, Connecticut.

Regulation 4.—Control of Movement of the Restricted Plants and Plant Products.

The movement of the articles enumerated shall not be allowed to any ɔoint outside of the areas designated as infested by the corn borer, unless ınd until such articles have been inspected by an inspector and certified to be ree from the corn borer: *Provided*, That certification for movement of corn ınd broom corn shall be restricted to clean shelled corn and clean seed of ɔroom corn: *Provided further*, That with respect to any article found to ɔe infested with the European corn borer disinfection or treatment may ɔe authorized by the inspector as a condition of certification for interstate novement when in the judgment of the said inspector such disinfection or reatment will eliminate all risk of transmission of infestation—such treatnent to be under the supervision of and satisfactory to the said inspector.

The restrictions of these regulations shall apply throughout the year to orn, broomcorn (including all parts of the stalk), all sorghums and sudan rass, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, ıollyhock, and cut flowers or entire plants of gladiolus and dahlia, except he bulbs thereof without stems; and for the period between June 1 and December 31 to celery, green beans in the pod, beets with tops, rhubarb, nd oat and rye straw as such or when used as packing.

No restrictions are placed on the movement from an area not under egulation through a regulated area of the articles when such movement is nade on a through bill of lading.

Regulation 5.—Marking and Certification a Condition of Interstate Transportation.

Every car, box, bale, or other container of plants and plant products of vhich inspection is required by these regulations shall be plainly marked vith the name and address of the consignor and the name and address of he consignee, and shall bear a certificate showing that the contents have ɔeen inspected by an authorized inspector and found to be free from corn orer infestation.

The inspection certificates in the case of carload and other bulk shipments hall accompany the waybills, conductors' manifests, memoranda, or bills f lading pertaining to such shipments.

Certificates of inspection will issue only for plants and plant products vhich have been actually inspected by the United States Department of Agriculture of the Connecticut Agricultural Experiment Station: *Provided*, That when in the case of individual premises or districts within an infested rea in any of the quarantined states it shall be determined by competent nspection that the corn borer does not infest any of the cultivated products rown in such premises or districts and that said premises or districts have een maintained in such condition of freedom from weeds or vegetable rowths other than the cultivated products designated as to prevent possiility of occurrence of the corn borer through such agencies, a certificate ood for not to exceed 30 days may be issued by the inspector stating that uch premises or districts have been inspected and found free from the corn orer and free from weeds or other extraneous vegetation capable of harɔoring the corn borer, and authorizing the shipment from said premises or istricts of any of the articles subject to this quarantine grown therein. Copies of such certificate shall be attached to small packages, or, in the ase of bulk shipments, to waybills, conductors' manifests, memoranda, or ills of lading pertaining thereto. Reinspection of the premises or district hall be a condition of the granting of further certification.

Regulation 6.—Conditions under Which Plants and Plant Products Originating Outside of the Infested Areas May Be Shipped from Points Within the Infested Areas.

Plants and plant products of which the movement is restricted by these regulations which originate outside of the infested area quarantined for the corn borer may be shipped from points within the infested areas to points outside such areas under permit from the inspector. Permits will issue only for plants and plant products which are not infested with the corn borer, and transportation companies shall not accept or move from within the infested areas such plants and plant products originating outside the infested areas unless each shipment is accompanied by a permit issued by an authorized inspector.

Regulation 7.—Conditions Governing Inspection and Issuance of Certificates.

Persons intending to move or allow to be moved plants and plant products for which certificates of inspection are required by these regulations will make application therefor as far as possible in advance of the probable date of shipment. Applications should show the nature and quantity of the plants or plant products which it is proposed to move, together with their exact location and, if practicable, the contemplated date of shipment. Applicants for inspection will be required to assemble the articles to be inspected and so to place them that they can be readily examined. If not so placed, inspection may be refused. All charges for storage, cartage, and labor incident to inspection other than the services of inspectors, shall be paid by the shipper.

Regulation 8.—Thorough Cleaning Required of Cars, Boats, and Other Vehicles before Moving Interstate.

Cars, boats, and other vehicles which have been used in transporting within the infested areas plant products covered by these regulations or any other articles which may hereafter be made subject thereto shall not be moved or allowed to move unless the same shall have been thoroughly swept out and cleaned by the carrier at the point of unloading or destination of all litter and rubbish from such regulated articles. No litter, rubbish, or refuse from any such plants and plant products shall be moved or allowed to move.

Regulation 9.—Provision for Inspection of Restricted Plants and Plant Products in Transit.

Any car, box, bale, or other container of plants or plant products moved or offered for movement, which contains or may contain plants or plant products the movement of which is prohibited or restricted by this quarantine and these regulations, shall be subject to inspection by duly authorized inspectors, at place of shipment or destination or at any point en route.

Regulation 10.—Shipments by the Connecticut Agricultural Experiment Station or the United States Department of Agriculture.

Plants and plant products the movement of which is restricted by these rules and regulations may be moved by the Connecticut Agricultural Experiment Station or the United States Department of Agriculture, when intended for experimental or scientific purposes, on such conditions and under such safeguards as may be prescribed by the Federal Horticultural Board.

This order including rules and regulations shall take effect June 1, 1927, and shall be in force until further notice.

W. L. SLATE,
Director, Connecticut Agricultural Experiment Station

Approved:
JOHN H. TRUMBULL,
Governor.

Of course the purpose of the quarantine is to prevent the shipment of infested material, and it will be unlawful to transport any of the plants or plant material named in the quarantine order to any point outside of the infested area without a permit or certificate. No certificate will be needed for such shipments within the quarantined area.

PENALTY

Chapter 107, Public Acts of 1925, provides that "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

PUBLISHED RULES AND REGULATIONS

Copies of the revised rules and regulations connected with the quarantines established on account of the European corn borer may be obtained from the following sources:

Connecticut Agricultural Experiment Station, New Haven, Conn.
Mr. R. S. Clifton, 12 South Market St., Boston, Mass.
Federal Horticultural Board, Washington, D. C.

INSPECTIONS

Arrangements have been made to have a Federal inspector stationed in New London, and he will inspect both interstate and intrastate shipments. His name, address, and telephone number are given below. Applications for inspection should be made to

MR. ANDREW B. ANDERSON,
Fisher Florist, Inc.,
104 State Street,
New London, Conn.

Telephone 44

BULLETIN OF IMMEDIATE
INFORMATION No. 60 JUNE, 1927

Connecticut Agricultural Experiment Station

New Haven, Connecticut

REGULATIONS FOR CARRYING OUT THE PROVISIONS OF THE LAW CONCERNING CONCENTRATED COMMERCIAL FEEDING STUFFS.

By the authority of Section 6 of the Act Concerning Concentrated Commercial Feeding Stuffs, Chapter 196, Public Acts of 1925, as amended by Chapter 29, Public Acts of 1927, the following regulations have been adopted for carrying out the provisions of the act. The sections cited under each regulation refer to sections of the law wherein the term defined, or the clause interpreted, occurs.

WM. L. SLATE,
Director of the Connecticut Agricultural Experiment Station.

THOMAS HOLT,
Dairy and Food Commissioner.

REGULATION 1. FEEDS NOT CLASSED AS CONCENTRATED COMMERCIAL FEEDING STUFFS.

(Section 1.)

It is held that the law exempts from classification as concentrated commercial feeding stuffs and therefore from registration (1) roughages such as hays, straws, corn stover, ensilage and all materials containing over 60 per cent of water; (2) whole grains and mixtures thereof; (3) meals made from whole grains when not mixed with other materials or with each other; (4) feed ground from whole grains and sold by the manufacturer directly to the consumer; (5) feed ground from materials furnished by the consumer; or (6) feed mixed according to a formula furnished by the consumer, for his own use.

Under the provision of clause 6 above, a feed must be sold as a formula only, without a private brand name and without analysis. But a feed cannot be offered for general trade as a formula in order to avoid registration and the registration fee.

Regulation 2. Method of Labelling.

(Section 2.)

All concentrated commercial feeding stuffs must be labelled either by a statement printed on the bag or upon a properly attached tag; except that in the case of cottonseed meal sold for fertilizer, or of any concentrated feeding stuff sold in bulk, a certificate which shall contain the information otherwise required to appear upon the bag or upon the tag, may be issued by the dealer in lieu thereof.

The use of wire or any metal in affixing tags is prohibited by law.

Regulation 3. Form of Label.

(Section 2.)

The law requires a statement of (1) the net weight of the feed contained in the package; (2) the name, brand or trademark under which the feed is sold; (3) name and address of the manufacturer or importer; (4) the minimum percentages of (a) crude protein and (b) crude fat, and the maximum percentage of (c) crude fiber contained in the feed; and (5) the separate ingredients of which the feed is composed.

While the law requires only a statement of the items enumerated above no objection will be raised to more complete statements of chemical composition.

Regulation 4. Duties of Manufacturers, Jobbers and Dealers with Reference to Registration.

(Section 3.)

All concentrated commercial feeding stuffs must be registered with the Connecticut Agricultural Experiment Station annually on January 1st, or before they are offered for sale.

Manufacturers, jobbers or individuals shipping feeds into Connecticut will be expected to register their brands and pay the necessary fees thereon. Connecticut dealers should assure themselves that the brands they handle are properly registered and labelled. In case the manufacturer or jobber outside the State neglects or refuses to register, the dealer who handles such feeds will be held responsible for such registrations, registration fees and other legal requirements.

Dealers within the State who mix their own brands are responsible for the registration and proper labelling thereof.

REGULATION 5. CONCERNING COTTONSEED MEAL.

Cottonseed meal sold as a fertilizer is required to be registered under the terms of the fertilizer law; if sold also as a feeding stuff it is required also to be registered under the provisions of the feed law; if sold exclusively for one or the other of these purposes, it may be registered only under that law which applies.

REGULATION 6. DEFINITIONS OF TERMS USED IN THE LAW, AND OF OTHER TERMS.

Person. The term "person" is accepted as defined in General Statutes, Chapter 128, Section 2448; it imports the singular or the plural as the case demands; and includes corporations, companies, societies and associations.

Importer. The term "importer" is defined in the Act.

Brand. It is held that a distinct brand name, or a distinct analysis, constitutes a distinct brand.

Nitrogen-free-extract. The term "nitrogen-free-extract" when used in a statement of chemical composition is held to mean that constituent group of substances represented by the percentage obtained when the sum of the percentages of moistnre, ash, crude protein, crude fiber and crude fat is subtracted from 100 per cent.

Carbohydrates. The term "carbohydrates" is held to mean nitrogen-free-extract plus crude fiber.

Definitions for Feeding Stuffs. The definitions and standards for feeding stuffs adopted from time to time by the Association of Feed Control Officials of the United States are accepted as official in carrying out the provisions of this law; and the rules and regulations as adopted by that association are accepted as far as possible and when not inconsistent with the Statutes.

REGULATION 7. METHODS OF ANALYSIS.

(Section 2.)

The methods of analysis employed shall be those prescribed by the Association of Official Agricultural Chemists, wherever such methods have been adopted for the determinations desired.

REGULATION 8. "STOCK TONICS."

The law does not include those medicated products used as conditioners for stock and poultry, and which consist essentially of substances possessing, or claimed to possess, medicinal or condimental properties.

Regulation 9. Concerning the Change in Registration Date.

In order to adjust registrations of feeding stuffs to the basis of the new registration period which is by calendar years, all registrations of record with this Station for the period September 1st, 1926 to August 31st, 1927, will be held to be in force until January 1st, 1928.

TEXT OF THE LAW

An Act Concerning Concentrated Commercial Feeding Stuffs.

(Chapter 196, Public Acts of 1925, as revised by Chapter 29, Public Acts of 1927.)

Section 1. The term "concentrated commercial feeding stuffs" within the meaning of this act shall include linseed meals, cottonseed meals, pea meals, bean meals. cocoanut meals, gluten meals, gluten feeds, dried brewers' grains, dried distillers' grains, malt sprouts, dried beet pulp, hominy feeds, cerealine feeds, rice meals, alfalfa meals, oat feeds, corn and oat chop, corn and oat feeds, scratch feeds, digestor tankage, ground meat scraps, ground fish scraps, mixed feeds, provenders, bran, middlings and mixed feeds made wholly or in part from wheat, rye or buckwheat, and all materials of a similar nature intended for the feeding of domestic animals, including poultry; but shall not include hays, straws, corn stover, ensilage, whole grains or the unmixed meals made directly from the whole grains of wheat, rye, barley, oats, Indian corn, broom corn, rice, buckwheat and flaxseed, or feed ground from whole grain and sold directly from the manufacturer to the consumer.

Sec. 2. Each lot or parcel of concentrated commercial feeding stuffs sold, offered or exposed for sale shall have conspicuously affixed thereto a plainly printed statement certifying (1) the number of net pounds of feeding stuff contained therein, (2) the name, brand or trademark under which the article is sold, (3) the name and address of the manufacturer or importer, (4) a statement of the minimum percentages of (a) crude protein, and (b) crude fat, and (c) the maximum percentage of crude fiber contained in the feeding stuff, all constituents to be determined by the methods adopted by the Association of Official Agricultural Chemists of the United States and in force at the time, and, (5) in the case of feeds composed of two or more ingredients, the name of each ingredient contained therein; provided such statement shall not be affixed by wire or other metallic device, and provided, in the case of cottonseed meal which shall be sold for fertilizer or in the case of any concentrated feeding stuff sold in bulk, the dealer may issue, in lieu of the printed statement herein described, a certificate which shall contain the information required by this section.

Sec. 3. Before any concentrated commercial feeding stuff shall be sold or offered or exposed for sale in this state the person who shall cause it to be sold or offered or exposed for sale shall file with the Connecticut Agricultural Experiment Station, on January 1, 1928, and annually thereafter, two certified copies of the statement prescribed in section two of this act, on forms supplied by the Connecticut Agricultural Experiment Station, and shall pay a registration fee of fifteen dollars for each brand to be sold or offered or exposed for sale in this state. When any feeding stuff shall have been registered and the fee paid thereon, the director of said station shall issue a certificate of registration for such feed, and a list of the brands so registered shall be published annually in the station report. Fees so paid to said station shall be used toward defraying the

expense of inspection. Whenever registration and payment as prescribed herein shall have been made on any brand of feeding stuff by any person, no other person shall be required to register such brand or to pay a registration fee thereon. The director may refuse registration of any feeding stuff, or may cancel any registration which shall have been made, if it shall appear or shall be found that all the provisions of this act have not been fulfilled, or if the feeding stuff shall bear any statement, design or device which shall be false or misleading as regard to materials of which it is composed. No feeding stuff on which registration shall have been refused or cancelled shall be permitted to be sold or offered or exposed for sale in this state.

Sec. 4. Every manufacturer, importer, agent or person selling or offering or exposing for sale any concentrated commercial feeding stuff in relation to which all the provisions of sections two and three of this act shall not have been complied with, shall be fined not more than one hundred dollars for the first offense and not more than two hundred dollars for each subsequent offense.

Sec. 5. The Connecticut Agricultural Experiment Station may collect a sample, not exceeding two pounds in weight, for analysis, from any lot, parcel or package of concentrated commercial feeding stuff or unmixed meals, brans or middlings, which may be in the possession of any manufacturer, importer, agent or dealer, but such sample shall be taken in the presence of the parties in interest or their representatives, and taken from a number of parcels or packages which shall not be less than five per centum of the whole lot inspected, and shall be thoroughly mixed, divided into two samples, placed in glass vessels or other suitable containers, carefully sealed and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was taken and the time and place of taking the same. Such label shall be signed by the station chemist or his deputy and one of such samples shall be retained by such chemist or his deputy and the other by the party whose stock shall have been sampled. Said station shall cause at least one sample of each brand of feeding stuff so collected to be analyzed annually by or under the direction of such chemist. Such analysis shall include a determination of crude fat, crude protein and crude fiber and any such other determination as may be advisable. Said station shall cause the analysis so made to be published in station bulletins, together with such additional information in relation to the character, composition and use thereof as may be of importance and shall issue the same annually or more frequently if advisable.

Sec. 6. The dairy and food commissioner and the director of the Connecticut Agricultural Experiment Station may make rules and regulations for carrying out the provisions of this act.

Sec. 7. The dairy and food commissioner shall enforce the provisions of this act and when evidence shall be submitted by the Connecticut Agricultural Experimental Station that any provision of this act shall have been violated, he shall make complaint to the prosecuting officer having jurisdiction thereof.

Sec. 8. The term "importer" shall include such persons as shall bring into or offer for sale within this state concentrated commercial feeding stuffs manufactured without this state.

Sec. 9. Sections 4774, 4775, 4777, 4778, 4779, 4780 and 4781 of the general statutes are repealed.

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